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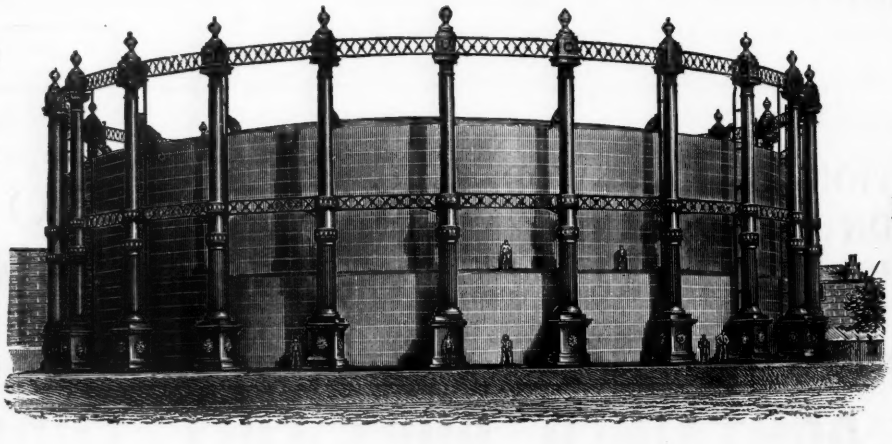

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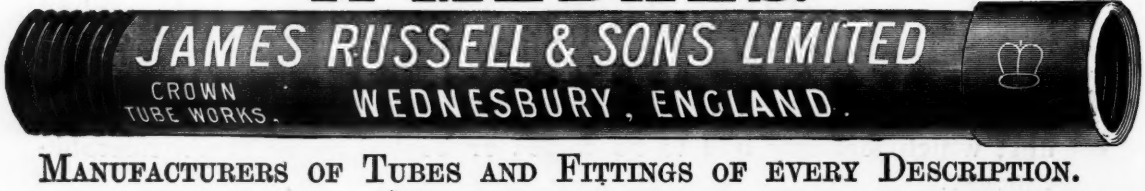

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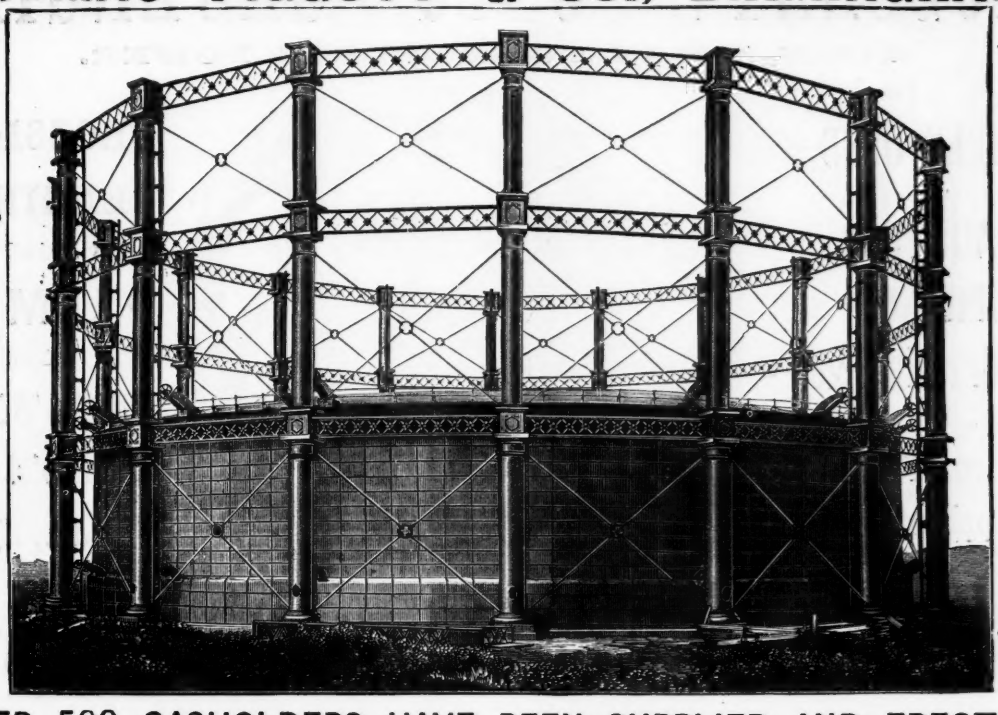

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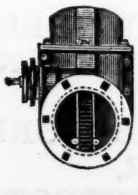

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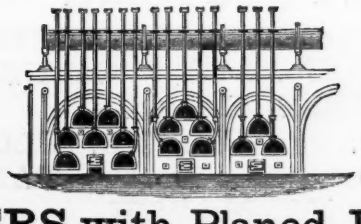

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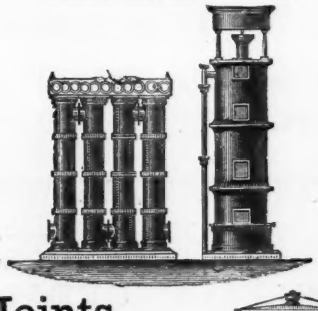

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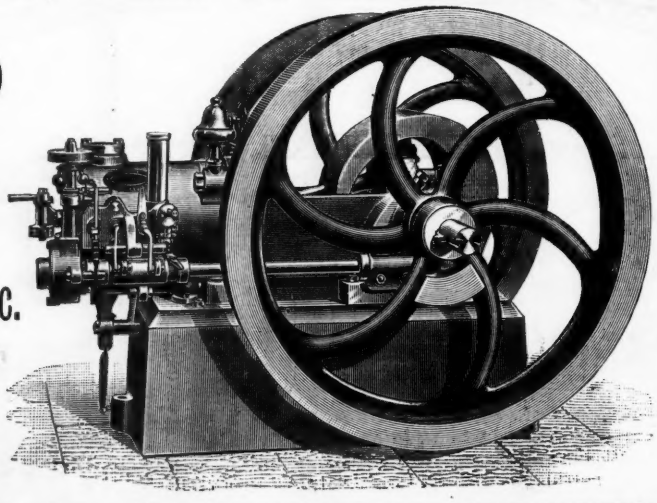

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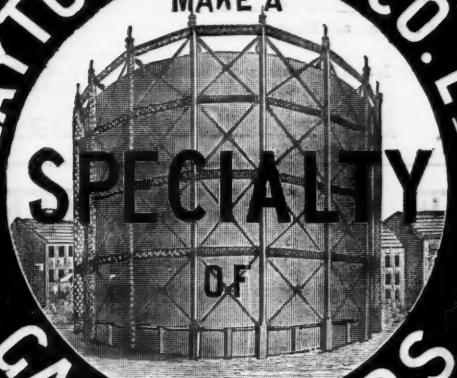

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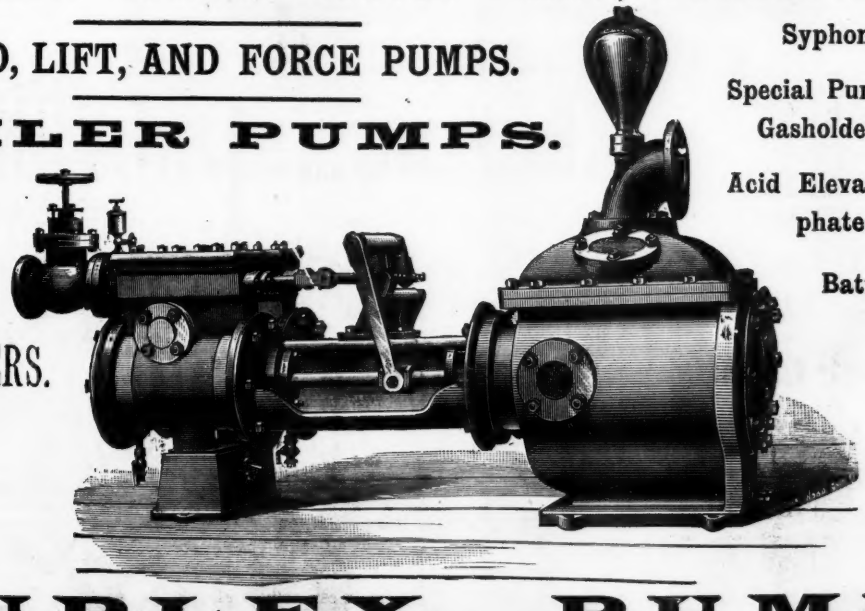

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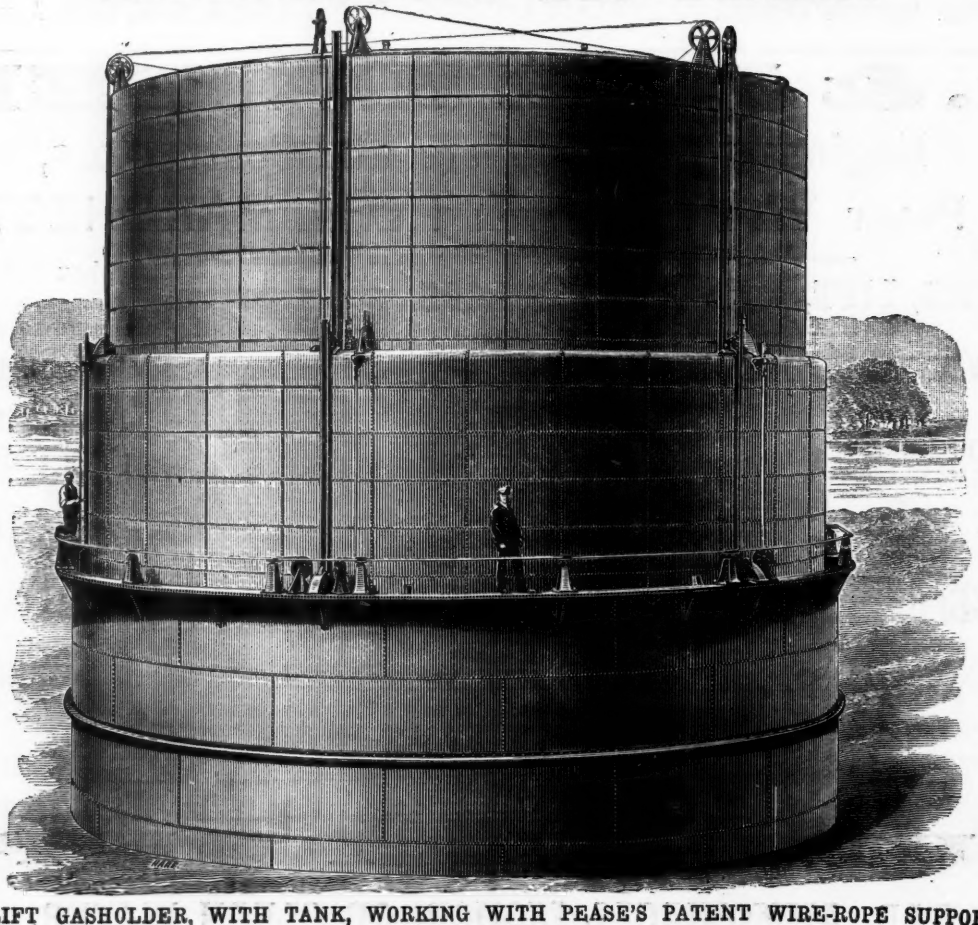

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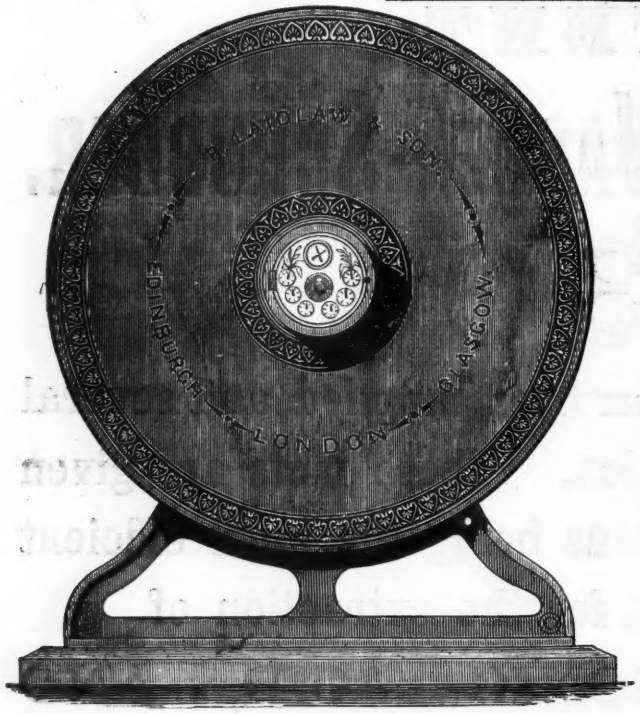

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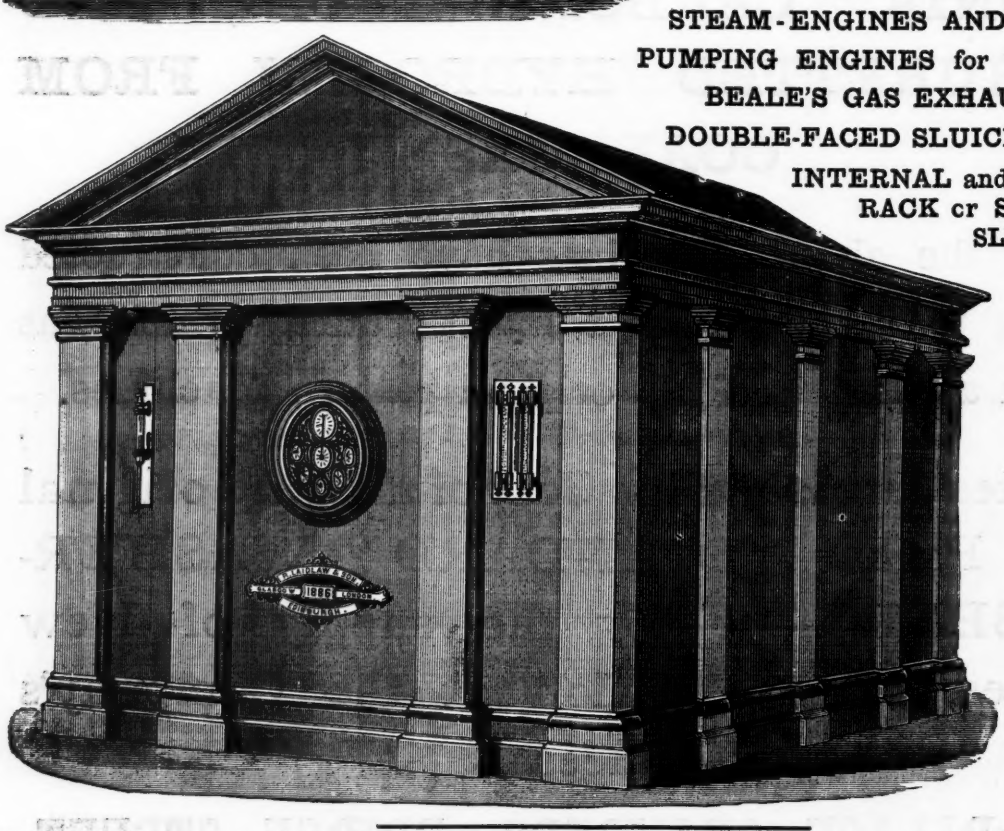

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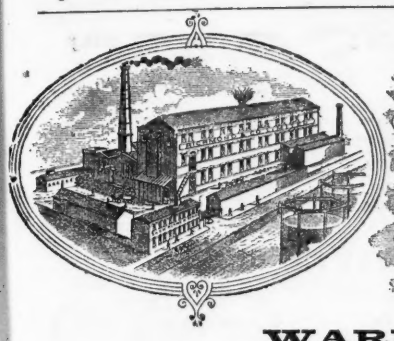

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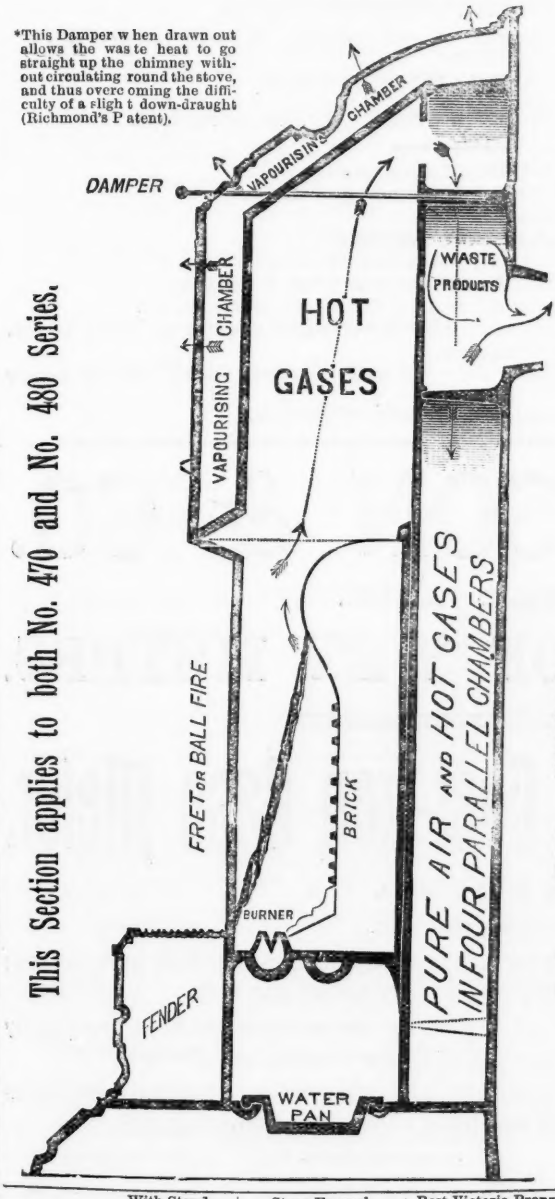

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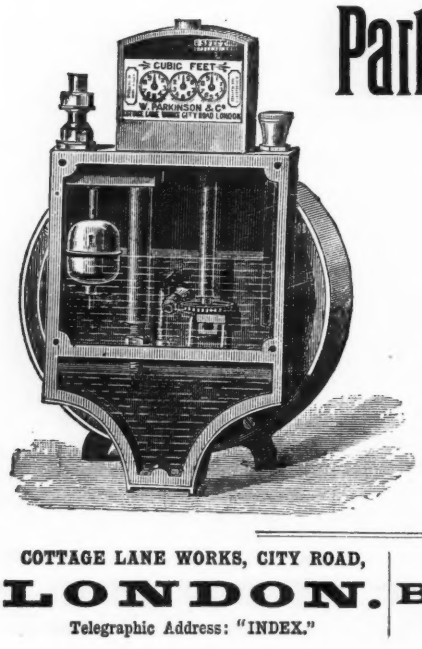

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Telegraphic Address: "GAS-METERS."

OFFICE: 10, MAWSON'S CHAMBERS, DEANSGATE,
MANCHESTER.
Telegraphic Address: "PRECISION."

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

The Question of Photometry 11
The Gas Supply of London and the Fog 12
Dr. Bunte's Experiments upon Coal 12
The Course of the Sulphate Market 13

WATER AND SANITARY AFFAIRS—
The London Water Bill of the Corporation and County Council 14
Mr. Archibald Dobbs on the London Water Companies 14

ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 15
Electric Lighting Memoranda 15
The Decay of the Contract System 16

COMMUNICATED ARTICLES:—
The Photometric Value of the Standard Sperm Candle. By W. C. Young, F.I.C., F.C.S., &c. 17
Lighting. Part III.—A Critical Examination of Modern Practice. By W. H. Y. Webber 18

TECHNICAL RECORD:—
Gas *v.* Steam Engines for Motive Power 19
The Dessau Central Electric Lighting Station of the German Continental Gas Company—Progress of the Undertaking from 1886 to 1891 21
Greenway's Sand Washing and Elevating Machine 23

REGISTER OF PATENTS:—
Production of Coke—Jones, F. J. 24
Igniting and Starting Arrangements of Gas-Engines—Lanchester, F. W. . 25
Igniting and Starting Gear for Gas-Engines—Lanchester, F. W. 25
Regenerative Gas-Lamps—Thomas, T. C. 25
Gas Motor Engines—Williams, H. 26
Withdrawing the Surplus Water from Reservoirs—Thompson, C. 26
Gas-Controllers—Brownhill, E. 26
Patent Notices 26

CORRESPONDENCE:—
The Proposed Investigation into the Standards of Light 27

MISCELLANEOUS:—
The Market for Sulphate of Ammonia during the Past Year 27
Mr. T. Canning's Lectures on Coal Gas—Explosions: Their Cause and Prevention 30
Birmingham Corporation Gas Supply—An Interesting Report 31
Coventry Corporation Gas Supply—The Alleged Nuisance from the Gas-Works: The Proposed New Works 31
Gas Supply in Foggy Weather 32
The Proposed Purchase of the Sutton Coldfield Gas-Works—Opposition of the Ratepayers 32
Meeting of the Automatic Coal-Gas Retort Company, Limited 32
Meeting of the Yorkshire Water-Gas Company, Limited 33
The Edinburgh Electric Lighting Scheme 33
Metropolis Water Supply—The Water Bills of the Corporation and the County Council 34
Cape Town District Water-Works Company 34
Notes from Scotland 34
Current Sales of Gas Products 35
Coal Trade Reports 35
Gas and Water Companies' Stock and Share List 36

PARAGRAPHS.—Mr. Elliot Smith, J.P., D.L., 13—Institution of Civil Engineers, 13—Methods of Collecting Water for Supply, 13—Mr. Benjamin Payne, 16—Sir W. Thomson, D.C.L., 16—Sugg's "Gas Engineer's Pocket Almanac and Lighting Table," 20—New Companies and Issues in the Past Year, 20—A New Lead Paint, 24—Liberty and Property Defence League, 24—Messrs. D. Hulett and Co., Limited, 26—The Reading-Room at the Dover Gas-Works, 26—The Gaslight and Coke Company's Assessment Appeals, 27—Failure of the Birmingham Compressed Air Power Scheme, 32—Hoyland Nether Local Board and the Gas-Works, 33—Fatal Accident at the Vauxhall Gas-Works, 35—Proposed Water-Works for Marlborough, 36—The Wages of Gas Workers at Kingston-upon-Hull, 36—A Generous Gift, 36—The New Water-Works for Burnley, 36—Longton (near Preston) Water Supply, 36—Rushden Gas Supply, 36—The Relative Cost of Gas and Electric Lighting, 36—Welsh Rivers and English Water Schemes, 36—The General Gas Lighting and Heating Company of Brussels, 36—Sales of Shares, 37—The Water Supply of Rotherham, 37—Companies Wound Up in the Past Year, 37—The Transfer of the Selby Gas-Works to the Local Board, 37—Polluting the Thames, 37—Water Supply of Adelaide, 37—The Costs of the Mersey Water Tunnel Litigation, 37—The New Welsbach Light, 37—A Fatal Gas Explosion, 37.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 5, 1892.

The Question of Photometry.

IN another part of the JOURNAL will be found some further communications on the (literally) burning question of light standards and the photometry of gas. As Mr. Charles Hunt, who has again written upon the subject, said in the letter which appeared among our last week's correspondence, this is a matter of widespread interest; and it is not to be supposed for an instant that the special need for action which the Board of Trade have just discovered in the arrangements for testing London gas, excludes the consideration of helpful suggestions from any quarter. It is to be hoped that everybody who has ideas relating to the subject generally, and is desirous of directing the attention of the Investigation Committee to any point of principle or of detail, whether connected with light standards, photometer design, standard gas-burners, or any other division of the questions to be submitted to the Committee, will forthwith take this opportunity of making his views known. We offer the publicity of the JOURNAL to all who may have fair reason to join in the discussion of the proposed work of the Committee which has been so well started by Mr. Leicester Greville and others. Whatever may be the nature of the commission given to the Board of Trade Committee, its members will see everything that appears in our columns with regard to their proceedings; and it will be idle for cavillers to complain at a future time that the case has not been fully laid before that body, if they now neglect this agency for publicity.

It may be as well to remark that, if anything in our own comments upon the present state of the standards question is read as limiting the range of the inquiry to be undertaken by the Committee, such an interpretation is quite foreign to our meaning. So far as the statutory regulation of gas-testing methods and apparatus goes, we may take it as certain that the Metropolitan gas engineers on the Committee will be careful to secure due observance of the principle that the *status quo ante* shall be the datum for all legislation upon the subject. That is to say, that when 16-candle gas is specified in any Act of Parliament or administrative notification applying to the gas supply of London (and inferentially of other places), it means gas as shown to be of this illuminating power by the apparatus and the photometrical practice in vogue at the period when this definition was legalized. Some authorities have gone so far as to assert that to lay down this principle is tantamount to claiming that defective apparatus and methods in photometry shall be perpetuated; but it is not so. The only purpose served by adhering to this principle is that improvements in photometry shall not be made at the expense of the gas. For example, supposing a gas examiner to have discovered a way of treating the candles which he uses as the standard of light, by which he can obtain more light from the sperm consumed, and this without breach of the letter of the regulations for the employment of such standard. We maintain that this method of enhancing the value of the standard, and consequently of depreciating the gas being compared with it, would be contrary to the meaning of the statutes applying to the matter. So also with the design of the photometer. The instruments in use at the period when the law of the matter was settled may have been imperfect. We are not prepared to say that they were or were not defective. But we argue that any so-called improved pattern of instrument cannot justly be used against gas without proper allowance being made for the instrumental variation. If, for instance, the brewing of beer had been so regulated by law—say, in 1840—that no liquor of the kind should be sent out of a higher specific gravity than a figure then stated, under penalty; and if, by 1890, a very much more accurate and sensitive form of hydrometer had been adopted by the supervising authority, would it be fair to use the latter as though it were interchangeable indifferently with the former? But the case in point is far stronger than this, because the specific gravity of a fluid with reference to an invariable datum, like the weight of pure water, is something that can be determined with a degree of certainty only depending upon the reliability of the instruments employed and the carefulness of the observer; whereas in the photometry of gas everything is indeterminate, and the standard is as liable to variation as the article of which it is supposed to be a measure.

With regard to the legalization of pentane, again, some of our readers, who doubtless have reasons of their own for their opinions, may think that our expressions unduly anticipate the decision of the Committee. If anybody takes a different view, now is his time for saying what is in his mind. We purposely laid great stress upon the prospects for the legalization of the pentane standard, in order to bring to a head, if possible, any lurking distrust of it which may exist with practical photometrists. If there are any such, who entertain, upon what appear to them to be sufficient grounds, dislike of the pentane standard, they had better make their protest now, "or here-" after for ever hold their peace." We believe the pentane standard has the best chance of adoption by the Committee; for the general reason that it has been reported favourably upon by every technical body which has been

charged with a similar inquiry to that now in contemplation. It is impossible to deny this fact. And now, when some of the most serious objections to the pentane standard as originally introduced have been overcome, it appears to be idle to blink the exceedingly strong probability that the new Committee will regard it with particular favour. There is something to be said for the view that the pentane standard is only the best of a poor show of substitutes for the candle, itself a discredited representation of the standard. But what can we have? A perfect standard of light may be still to seek; but it is not wisdom to despise what is good because it is not better. From all the evidence before us at present, we conclude that pentane holds the best place in the list of candle substitutes; but we are quite ready to listen to anyone who can reasonably maintain a different conclusion.

The Gas Supply of London and the Fog.

THE great fog which descended upon London and a goodly area of the South of England during the early part of Christmas week had very many striking consequences, not the least important of which were those relating to the supply of gas in the Metropolitan area during this period of continuous darkness and exceptional cold. The circumstances are worth putting on record, if only as illustrating the nature of the emergency with which the London gas engineers have to grapple without an hour's premonition. The weather during the whole of the week ending Dec. 19 was very clear and open; so that when, in the afternoon of this day, the various station managers left their posts in the north, south, east, and west of the great province of houses which they serve with gas, they had the satisfaction of perceiving that their stocks of this necessary of town life were in a healthy state for bearing the extra strain which the following week would be certain to bring. The weather was growing colder—a sharp frost having set in on the Friday night; and the barometer was steadily climbing up into "anticyclonic" readings. But Sunday came, and in some works the day gang lay off just as though it had been summer time. With Monday, however, the anticyclone became firmly established; and it was no longer doubtful what the weather in town was going to be for as long as the meteorological conditions remained unaltered. Next day was the worst that London has experienced for years. Blackness that could not only be felt, but also insisted upon being tasted, swallowed, inhaled, and otherwise fully realized, settled down upon the Capital, and lasted until the morning of Christmas Day. The demand for gas was unprecedented, for the weather was bitterly cold as well as hopelessly befogged; and the three London Gas Companies alone—to say nothing of the Suburban ones, which were all equally busy in their degree—sent out on Christmas Eve something like 170 million cubic feet of gas.

This is the bare statement of the facts; whereupon it seems natural to cry, "Good for the Gas Companies!" as many people did during those memorable four days. But what is the truth of the matter? It is that this remarkable fog, with its attendant frost, did the Gas Companies anything but good. Not only were their manufacturing resources and their distributing plant strained to the uttermost; but, since not a ship nor a barge moved on the river during all that time, they were unable to get in their customary supplies of coal, and were compelled to use from the store, which means additional expense. Then, although the "free" stokers of the South Metropolitan Company worked with hearty good will, giving the retorts all the coal they would take in, the same conditions were by no means universal; for, of course, Union principles cannot yield before such an ordinary trouble as a fog, and the "Union stroke" must be adhered to, fog or no fog. Moreover, every frozen public lamp or private service advertises itself by an irritating extinction or by a sadly insufficient supply, which proclaims to all observers that the circumstances are much too severe even for the Gas Company. And there is no use in denying the fact that, heavy as was the gas consumption in London during this Christmas week, it would have been heavier still if the public could have had as much gas as they wanted. In some districts at the beginning of the week, in others nearer to the end, gas-engines, gas-fires, gas cooking-stoves, and at last the lighting-burners, had to go short; and anything like this does infinitely more harm to the Companies than the sale of some extra gas can, under any circumstances, do good. So that, taking the matter all round, Gas Companies have quite as good reason as other interests and organizations—from railway company to pantomime managers—for wishing that the always congested business of Christmas week might never more be hampered as it was this time by a coincident anticyclonic frost and fog.

Mr. J. Orwell Phillips, the Secretary and General Manager of The Gaslight and Coke Company, was "interviewed" last week upon the subject of the fog, by a reporter of the *Daily News*, which journal printed a strange farrago of small-talk as the result of the conversation of its representative with the great man at the Horseferry Road. We were prepared to reproduce the substance of Mr. Phillips's story; but there is really nothing in it beyond the statement that the Company's output of gas on "Black Thursday" was 128 million cubic feet, and that three more holders are urgently needed. The reporter was evidently much impressed by Mr. Phillips's *bonhomie;* and his "copy" is sprinkled with repetitions of the "Ha! ha!" of this "humorous philosopher," as he calls his entertainer. And Mr. Phillips might well have laughed, behind the innocent reporter's back as well as in his face; for he managed to "rush" the inquisitive pressman for a column advertisement, without making the slightest allusion to the increase in price for which all London is abusing the Horseferry Road Administration. Most of the other London newspapers have noticed the advance, some of them in the most opprobrious terms; but not a sound of this seems to have penetrated into the *Daily News* offices. It is becoming more and more apparent, however, that Mr. Phillips will need all the humour and all the philosophy of which he may be master, to render this Christmas gift of his Company palatable to his customers. Moreover, it is only too likely that the increase in the price of gas to 3s. 1d. per 1000 cubic feet over the greater part of London will do more to discourage the use in the same district of gas-engines, gas-stoves, &c., than anything the worst enemy of the industry could have devised. In many cases, a rise of 7d. per 1000 cubic feet within eighteen months means completely turning the scale in favour of the steam-engine; while both electricians and oil sellers will take heart from the gas consumers' discomfiture. It is well for Mr. Phillips that he can laugh in the face of a newspaper reporter who happened to be unaware of these considerations; but there are others who do not regard the present position of The Gaslight and Coke Company as at all a laughing matter.

Dr. Bunte's Experiments upon Coal.

THE high reputation as a scientific gas maker already enjoyed by Dr. Bunte in this country, as well as in his own, will be enhanced by the recent publication in our columns, for the benefit of English-speaking gas engineers, of our translation of the Doctor's own account of his experiments upon coal, which originally appeared in the *Journal für Gasbeleuchtung*. It is too frequently seen that men of science hold aloof from those practical considerations which the men who have to do the work of the world are compelled to observe; so that there is a wide and deep gulf between the two classes of workers. How wide and deep the separation is, can hardly be realized by casual perusers of the philosophical journals and the Transactions of learned societies in which the former class of seekers after Truth are accustomed to enshrine their records of work done. They pursue Truth, with infinite pains, into the secret places where she lies withdrawn from careless eyes; but one is often struck by the reflection that the results of their labours often appear sadly disproportionate to the toil and care spent upon them. The *Comptes Rendus* of such a large and influential philosophical institution as the Académie des Sciences, for example, form two bulky volumes every year; but, upon the most liberal valuation, it would be difficult to say much for the net value of most of these records. This waste of learned labour is mainly due, in the estimation of outsiders, to the perversity of so many truly scientific men in electing to study subjects which are a long way removed from the concerns of common life. Far be it from us to defend a shallow Utilitarianism in technical research, which, when it is too "practical," is apt to be as fruitless as when its objects are wholly transcendental. There is a "golden mean" in this matter, as in all things. It is possible to admire the refined exactitude of method and the unselfish devotion to Truth shown by the man of pure

science, while at the same time wishing him to remember that he too lives on the earth with the rest of his kind. Dr. Bunte, as we understand him, is a man of science in its best sense. He keeps in touch with what the professors and the doctors in philosophy are doing in their laboratories; but he practises in matters which are of immediate concern to work-a-day humanity. He evidently holds that a boiler may be, in its way, as "scientific" an apparatus as a Berthelot calorimeter; and he tells, in the article now under notice, how he worked with a boiler and certain accessories with a view to making it reveal some previously unknown or misunderstood truths. It is impossible not to respect a man of science who tells us that "in practice, in many cases, the question is not so much "how to select any special kind of fuel, as how to make "the most of that which is to be had abundantly in a "particular district." Why, this is talk that goes right home to the understanding and appreciation of the most "practical" man who ever stoked a furnace. And it is as truly scientific as any disquisition upon the combustion-heat of a radicle of which not a pound exists in the world, that ever padded out the reports of the most high-and-dry Society for the Cultivation of Useless Knowledge. We hope that Dr. Bunte will give the world many more such specimens of sterling, thorough work, the usefulness of which consists not only in what they tell us, but also, and in an even higher degree, in the example they supply of how work of the kind should be conceived and carried out.

The Course of the Sulphate Market.

In another column will be found an abstract of Messrs. Bradbury and Hirsch's "Annual Review" of the course of the market for sulphate of ammonia. We must leave to the skilled authors of this valuable statement the difficult task of individualizing sulphate; only remarking that they do this so successfully as to impart a considerable degree of interest to the dry record of fluctuations in the market price of this useful article. It is with Messrs. Bradbury and Hirsch as with some other "reporters" on particular commodities—they seem to regard their selected market as something really possessed of objective existence. This creature of their imagination is, to their absorbed vision, endowed with a sentient personality; and its movements are only to be properly described in their chronicles in the terms proper to living beings. The market operator lays his finger, so to speak, upon the pulse of his subject; and his reports read like a physician's clinical notes on an interesting "case." We cannot aspire to such a flow of fancy. It is deplorable; but the truth remains that, as Peter Bell's "primrose by the river's brim, a yellow prim-"rose was to him, and it was nothing more," so in our clouded minds sulphate is something which gas manufacturers have to sell, and ought to turn into money at the earliest possible opportunity, without dwelling over much upon whether the market seems to be "flat," "active," "dull," or in any other condition describable in commercial, medical, or poetic language. We know, from repeated experience, how difficult it is to get at the truth respecting the sulphate market from time to time. It has been our endeavour to obtain, for the guidance of readers engaged in the business, reliable quotations of the current value of the principal bye-products of gas manufacture; but only those who have tried can realize how practically impossible it is to read the market at all times in a way that shall be satisfactory to buyers and sellers. Reporters are, of course, human; and critics usually find it easy to be wiser after the event than those who have a hand in the actual making of history. Until all the sulphate produced in England is sent to one market, and sold under the hammer every week, those who speak of its current value from time to time will continue to be flouted on both sides—by those who would like it to be dear, and by such as have an interest in seeing it cheap. Meanwhile, we take refuge in the simple faith that the best way for makers to treat their sulphate is to sell it off for what it will fetch. How futile it is for them to scheme for favourable market prices is clear from the reminder of Messrs. Bradbury and Hirsch that "the producing power "of the combined nitrate companies per month is equal "to that of Great Britain's production of sulphate per "annum." How far, and in what way, the price of nitrate governs the value of sulphate, our reporters profess inability to say. This is a study for "operators" in sulphate, not for the makers of it, who cannot shape their proceedings in accordance with market conditions, but must produce at the bidding of the consumers of gas.

It is to be noticed that Messrs. Bradbury and Hirsch put the price of sulphate low in comparison with that of other fertilizers; saying, indeed, that it is "unprece-"dentedly cheap." This being so, more money may be reasonably expected to be obtained for the spring deliveries; but to those makers who are wisely content to take matters as they come, this is not a very exciting prophecy. The prudent gas manager, even when he makes sulphate (which most prudent gas managers do), has enough else to think of without troubling himself with vain imaginings for the discomfiture of the "bears" of the sulphate market. He lets the "bulls" and the "bears" tear one another, which they will do cheerfully, whether or not he assists at the performance, just as the Laureate tells us that the "dragons of the Prime" amused themselves in this style, when there were no human spectators of their tournament. The most profitable study which the gas manager can give to his sulphate, particularly when he is in a small way of producing it, is in the direction of creating and fostering its local consumption. The difficulty here is the question of payment, when anything like a trade is attempted. A country gas manager finds an awkwardness in the contemplation of an annual sulphate paying day, which is customary with the manure agencies and the lime burners. But this difficulty must be overcome; and it is not insuperable when approached with the determination to succeed in dealing with it. Unfortunately, the wet and unseasonable autumn did not favour experiments with artificial manures in the United Kingdom; and it remains to be seen whether the farmers' circumstances will improve with the spring. By-the-bye how striking an illustration of the saying that the worth of anything is "just as much as it will bring" is afforded by the record of the average prices of sulphate of ammonia from 1882 to 1891. The product is precisely the same, and the cost of producing it from the raw material is practically constant; what was worth £20 8s. 6d. per ton eleven years ago, now sells for less than £11. There is a good lesson in economics to be extracted from these figures.

Mr. Elliot Smith, J.P., D.L., one of the founders of the Cambridge University Water-Works Company, and a Director until a short time since, died on the 23rd ult. The deceased, who was in his 81st year, had of late been suffering from bronchitis and influenza.

Institution of Civil Engineers.—Last Saturday was the 74th anniversary of the establishment of this Institution. Founded by six young men then beginning their engineering life, it has grown to be one of the largest bodies in the kingdom, numbering 6139 of all classes. In the Royal Charter of Incorporation, granted to the society in 1828, its object was stated to be for the general advancement of mechanical science, more particularly in its application to civil engineering; and some of the principal objects of the art were set out. It was, however, pointed out that "its scope and utility will be increased with every discovery in philosophy, and its resources with every invention in mechanical or chemical art." The range of practice has accordingly, during the last 50 or 60 years, become much enlarged.

Methods of Collecting Water for Supply.—At the fifth ordinary meeting for the present session of the Liverpool Engineering Society, held on the 23rd ult.—Mr. G. Farren, Assoc. M. Inst. C.E., in the chair—Mr. A. W. Brightmore, M. Sc., Assoc. M. Inst. C.E., read a paper, entitled "Methods of Collecting Water for Supply." The author commenced by dividing his subject into three parts: (1) Interception of rain water before reaching the earth, by collecting it directly in tanks or from the roofs of buildings. (2) Taking the water from streams or rivers, directly if the flow is sufficiently constant, or equalizing the supply by constructing a reservoir if the flow varies below the supply required. (3) Obtaining the water from the earth's crust by means of springs, shallow wells, intercepting tunnels or drains, or deep-seated wells. The author proceeded to discuss the probable state of purity of the water derived by each of these means, and gave examples of towns and cities, either in Europe or America, supplied on each system. It was pointed out that the supply obtained by direct interception could only be very limited. With respect to the supply procured from streams or rivers, it was shown to be freer from contaminating influences if obtained near to the source of the streams; hence the advantages of a water supply from an equalizing reservoir. Referring to the third method, water collected from shallow depths by means of wells or intercepting drains was shown to be useful for supply when it was derived from sparsely-populated districts. Water from deep-seated springs or wells, owing to its infiltration through the overlying strata, was often of great purity, and valuable for supply. An interesting discussion terminated the meeting.

WATER AND SANITARY AFFAIRS.

THE precise text of "the agreed Bill" of the Corporation of the City and the London County Council, by which the great question of the Metropolitan Water Supply is to be brought before Parliament in the coming session, is now available for criticism. The present title is that of the London Water Bill, and the main purport is twofold—namely, the establishment of a Water Committee representative of the County Council and the Corporation, and the giving of power to the Council to promote Bills in Parliament relative to the water supply. The constitution proposed for the Water Committee is the same as that with which our readers are already familiar. One-eighth of the members will be appointed by the Corporation, and the remaining seven-eighths by the County Council. Starting with a total of forty-eight, the number may be altered from time to time; but the foregoing proportion is to be preserved. The body so formed is to be "a "Committee of the London County Council." The Bill in the next place specifies the nature of the measures which the Council shall have power to introduce. By these Bills the Council may be authorized "to acquire, construct, and "maintain water-works, aqueducts, wells, reservoirs, and "other works, and do any necessary acts in connection "therewith, to afford a new or a supplemental water "supply." Or the Council may seek to acquire or take on lease any existing or future water-works, or the undertaking of any Water Company, "or any part thereof." No provision is made for the representation on the Water Committee of any of the authorities of the outer area; but the Council desire power to introduce such a Bill as would enable them to supply water in bulk to such authorities. The way being thus opened for the Council to bring their schemes before Parliament, the present Bill goes on to invest the Water Committee with power to make and enforce regulations respecting fittings and appliances to be used for preventing the waste, misuse, and contamination of water. This reads as if intended to take effect immediately; but we can hardly suppose such to be the case. The Committee are to have full power of inquiry as to the existing supply of water throughout the area supplied by the Companies; such inquiry to include the charges made for the supply, and an investigation into any "possible "sources." They will have authority to negotiate for the acquisition of water-works, subject to ratification by the County Council. The proposed powers of investigation respecting the works, plant, books, documents, and accounts of the London Water Companies are not to be exercised, except in pursuance of an order of a Magistrate, unless the Company agree to the proceeding. There will be delegated to the Committee, "absolutely and with-"out reference to the London County Council," all the administrative and executive functions of carrying on the supply of water from any works acquired, taken on lease, or constructed by the Council. But the Committee will not have power to purchase, sell, or let on lease any such works. They may not incur capital expenditure or raise capital, neither may they fix or alter the rates leviable for water, or the principle of charging or levying rates in respect of water supplied. All this, therefore, is reserved for the Council; and no provision is made by which the Corporation will have any voice in such grand transactions. The appointment of the Committee is to take place within six months from the passing of the Act. There is power to maintain offices, and form a regular staff; all expenses to be defrayed as for general county purposes. Such a Committee, we may venture to say, London never saw before. Perhaps, indeed, it will never see this. But while the proposal for the establishment of a Water Committee agrees with one of the recommendations of the Select Committee presided over by Sir Matthew White Ridley, the Bill contains a grave departure from a vital principle laid down by that Committee, which was that the County Council, if constituted the Water Authority, should be required to purchase the undertakings of the eight Metropolitan Water Companies, by agreement or by arbitration, "within a fixed period." The Bill contains no provision of this kind, but leaves the County Council free to purchase or not as they please; and, if they purchase, simply to take what they choose to bargain for, if anybody will sell to them. At the same time, there is the power to introduce "a new or a supplemental "water supply," which, as a matter of course, may take a competitive form. It will probably be remembered that the Corporation contemplated having a clause fixing a period within which the existing works should be purchased. But to this the County Council would not consent; and the Corporation thought fit to yield. We have no doubt that on this point the whole policy of the Council may be said to turn; and the Bill is framed to create machinery by which the Council may coerce the Companies. Although the measure is mainly a preliminary one, it serves to raise the main question; and it must be fought on that ground. Concerning the scope of the Bill, we may observe that it extends to the entire area over which the Metropolitan Water Companies "have power of "supply," although there is no provision for the representation of the outer area on the Committee. Perhaps we should add that Sir M. W. Ridley's Committee advised a parliamentary inquiry, if the existing undertakings were not purchased. The recommendation is one which may not be overlooked.

Mr. Archibald Dobbs has a characteristic article on "The London Water Companies" in the *Contemporary Review* for the present month. Having read all the Acts of Parliament connected with the Metropolitan Water Supply, and dived into all the Blue-books on the subject, Mr. Dobbs emerges with a conviction that what he has found is little else than chaos. He is distracted by the "highly irregular" nature of the rates of charge for the domestic supply; but when he comes to the non-domestic portion, he speaks of "confusion worse confounded." Having inquired, so far as might be possible, into these latter rates, he says: "I do not like to say what I know "of them." Mr. Dobbs has accordingly learned something, though his knowledge is simply vexation and sorrow. In every Act there is a list of purposes which may "not" be included in a domestic supply. But the list is said to be "drawn up with abominable vagueness;" and by way of a general conclusion we are told: "The "whole of the sections, and every London Special Water "Act, are a monumental scandal." These Acts, Mr. Dobbs asserts, "are so loosely drafted that they contain "every fault a draftsman can commit;" and nobody knows "the true meaning and construction" of sundry important sections. All this sounds very dramatic; but we question whether even the genius of Mr. Dobbs could frame a satisfactory definition in each particular case. Not "every "garden" is made the subject of an extra charge by a Water Company; and it is notorious that in a very large number of cases the Companies take no notice either of a garden or a bath. But amid all the confusion which fills the mental vision of Mr. Dobbs when surveying the Metropolitan Water Question, there is one point concerning which he announces a clear and unmistakeable discovery. He states that when the Metropolis Water Act of 1852 was before the Select Committee, the Counsel for the Chelsea Company pledged that Company and five others that if certain rates were granted to them, with power to levy up to the maximum, they would only exact the customary rates, and would regard the maximum as never to be reached or approached, "except in cases of "extraordinary and exceptional use of water." Mr. Dobbs says it was on the faith of that promise and undertaking, again and again declared, that the Committee "recommended the adoption of the new scale and basis of "rates." He admits that such a compact could not be taken account of in a Court of Law; but he describes it as "one conspicuous mark of the incapacity and ineptitude of the Corporation of the City in dealing with this "subject," that, although distinctly informed of such a compact, they failed to recognize its existence. Mr. Dobbs says the promise made was observed for some time. It seems it must have been kept for about thirty years. Perhaps it would have been maintained by the Companies until now, had not the "basis" of the agreement been disturbed by the substitution of "rateable" for "annual" value—a change in which Mr. Dobbs took an active part. Possibly the Corporation were not so inept as to be unmindful of this. The compact has been clearly broken on one side, leaving room for a contention that it was no longer obligatory on the other. The legislative tinkering which has gone on with respect to the London Water Companies, coupled with one or two rather erratic decisions in the Law Courts, has not tended to diminish the confusion of which Mr. Dobbs so vehemently complains.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 36.)

THE closing week of 1891 was a satisfactory one in the Stock Markets, despite the usual interruption to business caused by the holidays; and with the opening of a new year on Saturday a disposition to take a brighter view of things in general manifested itself, which it is hoped may be a happy omen of the future. The sudden hardening of the Money Market in the earlier part of the week, had a somewhat deterrent effect upon the upward tendency of prices; but this being subsequently relieved, a general improvement took place. The Gas Market had its fair share of the rising tide; and though business was very quiet until after the settlement, many quotations closed at a moderate advance upon the previous week's figures. Gaslight "A" started at 221, and touched 225; the final quotation showing an advance of 2. Some of the debenture and preference issues changed hands at good prices; but the "H" 7 per cent. limited receded 2. In South Metropolitan, the "B" recovered 1. Commercials did not move at all. Several debenture stocks were quoted *ex div.* at fractionally better figures. Among the Suburban and Provincial Companies, the only feature was a relapse of 2 in Bristol. The Continental undertakings continued very firm; and Imperial advanced 1½. Of the Orientals, Bombay showed a tendency to advance. The South Americans were no better; and Buenos Ayres fell ½. The Water Companies have shown more activity and recuperative power; almost all quotations having risen considerably.

The daily operations were too slight to call for notice; but the following movements may be noted: On Monday, South Metropolitan "B" rose 1; and Bristol fell 2. In Water, East London and Grand Junction rose 1 each. On Tuesday, Continental Union advanced 5. In Water, New River rose 5; Kent, 2½; West Middlesex, 2½; and East London, 1. On Wednesday, Imperial Continental went up 1½; East London Water, 2; and Southwark, 1½. The only move on Thursday was a rise of 5 in Kent. On Saturday, Gaslight "A" rose 2; but the "H" fell 2. In Water, Chelsea rose 5; and East London, 1.

In accordance with our usual practice, we append a comparative table of the quotations of Gas and Water Securities at the close of 1891, and as they were twelve months before; showing their respective gains and losses. It will be seen that, with rare exceptions, quotations of Gas issues have fallen. The Metropolitan Companies are considerable losers. A great deal of this is attributable to the high price of coal; for although coal was cheaper in the latter part of 1891 than it was a year previously, yet the stock quotations at the close of 1890 had not felt the full effect of the high price, and the Companies' accounts issued in 1891 showed then for the first time the actual position. Another group that has receded largely is the South American, the cause of which is sufficiently notorious. But the largest shrinkage in value is to be found in the Water Companies, owing in a great degree to the fear of measures being introduced for the acquisition of the Companies' undertakings by a public body upon terms savouring of spoliation. At the moment of writing, however, a more reassured feeling is discernible in the market.

NAME. GAS COMPANIES.	Prices on Dec. 31, 1890.	Prices on Dec. 31, 1891.	Gain or Loss.
Alliance and Dublin Company, 10 per cent. maximum	16–17	15½–16½	–½
Do. 7 per cent.	12–13	11–12	–1
Australian (Sydney) 5 per cent. Debentures	107–109	107–109	—
Bahia, Limited	17–19	12–14	–5
Bombay, Limited	6¾–7¼	6¼–6¾	–½
Do. New	5–5½	4½–5	–½
Brentford, Consolidated	212–217	210–220	+½
Do. New	155–160	157–162	+2
Brighton and Hove, Original	40–42	40–42	—
Bristol	—	98–103	*
British	43–45	42–44	–1
Bromley, ordinary 10 per cent.	18–20	18–20	—
Do. 7 per cent.	13–14	13–15	+½
Buenos Ayres (New), Limited	11–12	6–7	–5
Do. 6 per cent. Debenture	103–105	92–96	–10½
Cagliari, Limited	26–28	24–26	–2
Commercial, Old Stock	250–254	240–250	–7
Do. New do.	198–203	185–195	–10½
Do. 4½ per cent. Debenture Stock	117–122	117–122	—
Continental Union, Limited	47–49	215–225	*
Do. 7 per cent. Preference	37–39	185–195	*
Crystal Palace District	195–205	190–200	–5
European, Limited	19–20	19–20	—
Do. Partly paid	13½–14½	14–15	+½
Gaslight and Coke, A, Ordinary	240–245	219–224	–21
Do. B, 4 per cent. maximum	98–101	94–97	–4
Do. C, D, and E, 10 per cent. Preference	249–254	248–253	–1
Do. F, 5 per cent. Preference	119–123	118–123	–½
Do. G, 7½ per cent. Preference	177–182	172–177	–5
Do. H, 7 per cent. maximum	164–168	155–160	–8½
Do. J, 10 per cent. Preference	247–252	245–250	–2
Do. K, 6 per cent. Preference	147–152	145–150	–2
Do. 4 per cent. Debenture Stock	111–116	110–114	–1½
Do. 4½ per cent. Debenture Stock	121–125	118–123	–2½
Do. 6 per cent. Debenture Stock	158–162	160–165	+2½
Imperial Continental	220–225	220–224	–½
Malta and Mediterranean, Limited	5–5½	4–4½	–1
Metropolitan of Melbourne 5 per cent Debenture Stock	109–111	109–111	—
Monte Video, Limited	18½–19½	15–16	–3½
Oriental, Limited	8¾–9¼	8¼–9	–½
Ottoman, Limited	5–5⅛	4–5	–1⅛
Pará, Limited	3–4	2½–3½	–½
People's Gas of Chicago, 1st Mtg. Bds.	95–100	94–99	–1
Do. 2nd do.	93–98	93–98	—
San Paulo, Limited	15–17	11–12	–4½
South Metropolitan, A Stock	280–285	265–275	–12½
Do. B do.	228–233	220–225	–8
Do. C do.	235–245	225–235	–10
Do. 5 per cent. Deb. Stk.	140–145	138–143	–2
Tottenham and Edmonton, Original	11–13	11–13	—
WATER COMPANIES.			
Chelsea, Ordinary	267–272	250–260	–14½
East London, Ordinary	213–218	202–207	–11
Do. 4½ per cent. Debenture Stock	140–145	136–140	–4½
Grand Junction	117–122	98–103	–19
Kent	273–278	265–275	–5½
Lambeth, 10 per cent. maximum	245–250	220–230	–22½
Do. 7½ per cent. maximum	195–200	189–194	–6
Do. 4 per cent. Debenture Stock	120–124	120–123	–½
New River, New Shares	360–365	335–345	–22½
Do. 4 per cent. Debenture Stock	125–128	125–127	–½
Southwark and Vauxhall, 10 per cent. max.	175–180	147–152	–28
Do. 7½ per cent. maximum	167–172	138–143	–29
West Middlesex	260–265	245–255	–12½

* Capital remodelled.

ELECTRIC LIGHTING MEMORANDA.

The Prospects of Electric Light Companies—Two Views of the Cost of Electric Lighting—Electrical Construction Companies—Electric Railways in Parliament.

THE electric light companies begin the New Year under peculiar conditions. Up to the present time these undertakings have subsisted very largely upon hope and fair expectation; but this state of existence cannot last for ever. The accounts which some of the oldest of the Metropolitan Companies must publish during the year upon which we have now entered, will show what amount of justification there is for the promises by virtue of which these concerns obtained their capital. It is impossible to postpone the day of reckoning indefinitely, albeit there is small doubt that the Directors of more than one company of this description would like to follow the custom of insurance companies, and refrain from saying anything about profits or dividends until the expiration of the fifth year from commencing business. The law being as it is, however, and the circumstances what they are, we candidly confess that we look forward to the revelations of the current year as likely to clear up a good deal of prevalent uncertainty with regard to the commercial side of electric lighting. The people who have speculated in these companies' shares naturally hope that their ventures will, sooner or later, come safely into port. But, notwithstanding the persistent advertisement that partizans of electric lighting seem always able to command, this class of shares still fails to take a good position in the investment market, and the financial newspapers are repeatedly moved to explain the reason for this deplorable state of things. The last effort of this kind that has come under our notice is the production of that "trustworthy" print, the *Financial News*, which says of the electric light business for 1891 that "this interesting enterprise, freed from stupid and harassing legal restrictions, has been able both to demonstrate its possibilities as an illuminant, and to reinstate itself in the opinion of the investor." Yet in the very next sentence the writer goes on to observe that, "partly owing to imperfect scientific knowledge, but still more to unscrupulous financing, the early history of the electric light in England was a history of disaster." How can such confused and contradictory explanations be reconciled? It will occur to most impartial readers of these remarks that if it was the "unscrupulous financing" that ruined the electric light business from its start, it is a pity that the so-called "stupid and harassing legal restrictions" were not a great deal more stringent than seems to have been the case.

In the course of the *Financial News* article referred to above, this statement occurs: "It seems certain that for a long time, to come, always excepting the possibilities of discovery, the sheer cost of producing the electric light must be greater than that of producing gas." This remark brought up a reply from Messrs. Crompton and Co., Limited, who seized upon the phrase about the cost of *producing* the electric light as an excuse for asserting that the statement is wrong, and that the "sheer cost" of generating electricity for the purpose of lighting has actually been reduced to the low figure of 2d. per Board of Trade unit. Messrs. Crompton admit that there is, for various reasons, a great discrepancy between this figure and the cost at which supply companies can afford to sell the unit of electricity; but they declare that the disproportionate expenses which at present account for this discrepancy will be reduced as the scale of production increases; so that, "when the scale of production is as great as that on which gas is now produced, the cost will be the same, or even lower." Touchstone pointed out the great virtue that resides in an "if;" and there is the same quality in Messrs. Crompton's "when,"

which must be taken to cover such a long-dated draft on the future that the drawers are never likely to be called upon to redeem it. Meanwhile, a matter-of-fact person, writing from the City, has the effrontery to say that, whatever the actual cost of production may be, he knows by experience that "the cost to the consumer of the electric light within the limits of the House-to-House Company is certainly not less than three times that of gas." And the same inconsiderate individual goes on to assert, in direct opposition to a cherished idea of the electricians, that "three Edison-Swan 8-candle incandescent lamps do not give a light for reading and working purposes equal to three 5-feet Peebles gas-burners." If there are many subscribers to electrical supply companies of the same mind as this outspoken gentleman, it can hardly be regarded as good for those undertakings.

Two electrical construction companies held their statutory meetings near the close of the year—the Company that was formed to take over the Elwell-Parker business, and that which is exploiting the Immisch system. Both undertakings claim to be doing fairly well; the former particularly so, inasmuch as they have paid for the second time a dividend after the rate of 6 per cent. It is difficult, however, to form a trustworthy opinion respecting the true position of enterprises of this order, especially in the early days, when there is money at the bankers', and several heavy cross entries appear in the accounts. They are all more or less fighting concerns—the privateersmen of industry, so to speak—and deal in patents, concessionary companies, and uncertain property of other kinds, mostly partaking of the general character of appearing like a valuable asset so long as it is not subjected to the test of realization. As with the various lighting companies which they help to start on their way, so these construction companies have not yet lived long enough to test the real value of their founders' prospects. In the case of the Elwell-Parker concern, moreover, it may, of course, be perfectly right and proper for a manufacturing firm to spend £11,400 odd for the expenses of the head office, and another amount of £13,000 for advertising their debentures, law charges, "&c.;" but we take leave to doubt whether a mere workshop connection in the electrical way can bear such impositions. So long as the merry game of subsidiary company promotion can be kept up, this sort of thing may be endured; but the game in question is one that does not, generally speaking, last longer than a year or two.

Mention of the doings of electrical construction companies leads to the consideration of the electric railway projects that will engage the attention of Parliamentary Committees next session. The number of these schemes is eloquent testimony to the avidity with which speculators will take hold of any description of electrical enterprise that offers even the faintest prospect of earning a dividend. It is true that the City and South London Railway does not pay as yet; but this failure is ascribed rather to general causes than to any radical defect in the system of locomotion adopted. At any rate, several other underground electrical railways are being projected for London, besides two or three in the country; and if we are not to dismiss the whole of these as "contractor's jobs," they must be regarded as good evidence of the existence of people who honestly believe that there is something in the electric railway business. Suggestions are made for solving by electrical locomotion that long-standing puzzle of the Metropolitan railway system—the provision of a direct connection between the Waterloo Terminus of the London and South-Western Railway and the heart of the City. The direct connection by the same means of the northern and southern trunk-line systems is also engaging the attention of the electro-locomotive engineers. We sincerely hope that good work may be done in this field. There is plenty of room in London for several more rapid-transit devices; and it would be satisfactory to see the graduates in Electrical Engineering of the City and Guilds of London Institute better employed, if only as guards or switchmen upon electrical tram lines buried safely out of the way in the subsoil of London, than they are likely to be while lighting is their chief study.

Mr. Benjamin Payne, one of the founders of the Tunbridge Water-Works, has just passed away at the advanced age of 89.

Sir W. Thomson, D.C.L., President of the Royal Society, has had the dignity of a peerage of the United Kingdom conferred upon him by Her Majesty, as a New Year's Honour.

The Price of Gas in Brussels.—After much consideration and discussion, the Brussels Municipal Council have come to a decision on the question of the price of gas. It will probably be remembered that M. Richald brought forward a proposition to make the rate 12c. per cubic metre all round, instead of having a lower price for the gas used for cooking and motive power. To this a counter-proposition was submitted by M. Allard, to make the charge for gas used for domestic purposes, whether in the daytime or otherwise, 10c., and retain the existing price of 14c. for lighting gas. After a debate which was not remarkable for wisdom, this suggestion was adopted by 21 votes to 7. The result is that those who require a supply of gas at the lower rate will have to take it through separate service-pipes and meters—an arrangement which assuredly will not commend itself to intending consumers.

THE DECAY OF THE CONTRACT SYSTEM.

Something was said in the Retrospect of the past year, which was given in the last number of the Journal, respecting the difficulty of noting at the time the beginnings of fresh industrial movements which afterwards develop sufficient importance to render memorable the era of their birth. One always seems to be living in an age of small things. Everything must have a beginning; and this beginning is usually so small and obscure that it is next to impossible to predict its future increase until this has become manifest, when prediction has to be changed for history. So many of the tendencies of the age in which one lives die out before coming to anything; so many promising beginnings never get any farther; so many revolutionary principles, in industry as well as in politics and social affairs, wilt under our eyes, even while their propounders are busily occupied in explaining their nature and object—that wise observers of the signs of their own times are careful how they form the opinion of any particular movement that it contains within itself the guarantees of growth and endurance. It is therefore with some diffidence that we invite the attention of our technical readers to the consideration whether, and to what extent, it can be said of the last year or two that they have witnessed the commencement of the decay of that once potent personage, the general engineering contractor. The question is both interesting and important, and has, moreover, so many bearings, that, unless its application is strictly limited to a particular order of cases, it will be extremely difficult to arrive at a definite conclusion in the matter. It may therefore be admitted at once that, for some purposes, we are likely to have the building and engineering contractor among us for many years longer. So long as non-technical bodies and private individuals continue to require, as they do, all kinds of building and engineering work, so long will they prefer, in the majority of instances, to contract with skilled persons for the execution of such work for a lump sum, in order that they may know what they will have to pay, and be relieved of all responsibility for the due performance of the constructor's task, whatever it may be. It is obvious, however, that contractors for the construction of building and engineering works have hitherto found employment under a very much more numerous and influential order of patrons than such as come into this category. It has been, and still is, customary for industrial and commercial concerns of all magnitudes to "put out" their constructional work, as well as many other services, under contract; and it is in connection with this class of contractor's patrons that we desire to discuss the question which constitutes the text of this article,

The term "contractor" is almost as elastic as that of "commission agent" in trade and industrial vocabularies. Of very many so-called contractors it may be said that they are nothing else than middlemen; and the latter term has not a pleasant savour in the nostrils of the present generation. Contractors have had a great deal to do with the business of gas supply, from the earliest times to the present day. It was once a common thing for contractors to occupy the middle place between a gas company and the consumers. The gas company was merely the financial organization for bringing gas lighting into a particular district; the works were built by contract, and managed by contract. It was nothing less than a revolution in the gas supply of whole provinces of the United Kingdom when gas companies were prevented from delegating their responsibilities, and gas-works lessees were consequently disestablished. We have no intention of bringing a general accusation against lessees of gas undertakings. There were black sheep among them, of course, and the temptations of the position were such as to handicap honourable dealers. But there were many able and honest men in this line of business, whose example spurred the statutory companies to conduct their affairs upon commercial principles. Moreover, the age of the gas-works lessees was the hey-day of middlemen. Vast undertakings of every kind now administered at first hand, were farmed out to shrewd business men, who, for guaranteeing the capitalist his dividend or interest, were allowed the fullest opportunity of scraping an additional profit for themselves. There have been few industrial movements of greater moment in this century than the general suppression of the order of "lessees"—that is to say, of middlemen contractors.

When the lessees disappeared, however, gas companies, like railroad and steamship companies, and many other well-established interests, still found themselves committed to a system of business of which contractors held the keys. Everything that was purchased was contracted for; and it was the same with all services that demanded anything like commercial aptitude or organizing ability in the performance. Either gas company directors entertained a profound distrust of the capacity of their officials, or the latter aimed at making things comfortable for themselves at any cost. But, whatever the motive, it is certain that many gas companies continued the practice of paying dearly for the convenience of relying upon middlemen for performing services which the company's own officers ought to have undertaken. Would we could describe the custom as obsolete. Unfortunately, it is too well known that it is still rooted in the policy of many gas administrations; and the fact that these are the undertakings which are unable

to sell gas cheaply, does not appear to enlighten those who are responsible for maintaining such practices. It is only when fossilized directors and managers are removed in the ordinary course of nature, that radical alterations of policy can usually be effected.

Yet there cannot be any mistaking of the right course in this regard, by those who keep their eyes open to what is going on around them. One after another the gas companies, water companies, and railway companies of the United Kingdom are doing more and more of their own work, and emancipating themselves in the same measure from the burden of maintaining contractors in the position of middlemen. The contracting system is crumbling on all sides, and dying out altogether wherever it can be spared. Some undertakings are more advanced than others in this respect; but if we confine our observations to the gas industry alone, it would be easy to find striking examples of companies and local authorities doing for themselves, with the greatest ease and comfort, things which more backward administrations still continue to "put out" to contract. Some gas companies do not seem able to set a retort, build a shed, lay a main or a service pipe, discharge a cargo of coal, get in a barge-load of bricks, repair a stove, or paint a gasholder without employing contractors. Why is this? There may be two reasons for putting out the work of a gas factory to contract: It may be very casual or infrequent work; or the management may be weak, and unwilling to incur responsibility. The former, so far as it goes, is a good excuse. Nobody would expect a gas company to keep up gasholder-making plant for use only every six or seven years, or to provide an iron foundry for the casual repair of castings not in sufficient demand to keep a moulder occupied. But when work is contracted for outside merely because of incompetency at home, it simply means that the cost of management is indirectly increased accordingly.

It is a difficult and often a thankless task for a gas manager who has been trained in a modern undertaking, where everything possible is done on the premises and at first hand, to break through the contrary system when he finds himself in independent control of a works whereon contractors have battened from time immemorial. He feels constrained by his sense of duty to stop the multitudinous issues which he sees to be draining the life-blood of the concern; but where is he to begin? Next to his Board, the first people he comes in contact with are the contractors for coal, cartage, lighterage, building, repairs, mainlaying, and all the rest of it; and, it is necessary to say that, from the manner in which some of these gentry are recommended to his kind consideration by old stagers on the Board or in the undertaking, the new manager is often able to form a shrewd opinion as to where lies the greatest interest in the contracts. Even where there is no apparent ground for suspecting the existence of those "wheels within wheels" which make of some gas undertakings such marvellously intricate pieces of mechanism, the manager or the director who comes fresh into an old-fashioned concern of the kind, will do well to keep his reforming zeal out of sight for awhile, until he has the run of the "ins and outs" of the whole affair. The contractors are such capital good fellows, as a rule, and do their work so well—when things are going straight—that it seems a thousand pities not to leave well alone. An opportunity for making a change is certain to present itself sooner or later, however; and then is the time for the reformer to show whether he has the tact by which reforms are carried out without giving offence, as well as the knowledge of what ought to be done. The best aid to the disestablishment of the contract system is command of the history of contracts; and in this record, the back volumes of the JOURNAL are rich.

For it is of the essence of the contract system that it shall be profitable to the contractor. So long as this condition prevails, everything will work well. When the circumstances change, however, the trouble begins; and those who patronized the contractor in order to save themselves trouble, discover that he expects to be paid for doing their work at a higher rate than they could do it for themselves. Moreover, there is something very unpleasant in the spectacle of a local authority, or a gas company protected by statute in the enjoyment of good dividends, wringing the last sovereign out of a poor wretch of a contractor who has put himself between the rich corporation and an adverse market. We have published so much upon this aspect of the question on former occasions, that it is unnecessary to say much about it now. Contracts when made must be upheld, of course, or the fabric of the industrial world will fall in pieces. It is worth pointing out, however, that the unrighteousness of Shylock consisted, not so much in insisting upon his bond (in which he was justified by the law) as in proposing the terms of that remarkable contract, which the other party was constrained to accept. So that one's sense of justice is offended when a municipal corporation or a statutory gas company, neither of whom can lose money by the influence of adverse markets, enters into engagements with unprotected contractors which may result in the ruin of the latter from this same cause. If the form of a contract must be adhered to in the matter of purchasing gas-works supplies, the only sound policy is to shorten the term during which the engagement is binding.

When a contract has been made, it is as a rule highly undesirable to vary its terms in any important respect. We too frequently hear of gas coal contracts which, on account of an alteration of views on the part of the buyers, or for some other plausible reason, are tinkered out of all shape before they run out. It is notoriously the policy of some coal contractors never to allow a contract to run its natural course, if they can help it, without making it the subject of some "arrangement," or "understanding" having reference to future business. This is a peculiar vice of the system of long coal contracts; and is only to be avoided by restricting the duration of such engagements to periods which fall within the range of ordinary commercial providence.

It may be remarked by some professional readers that, while the evils of the contract system can be avoided or mitigated in regard to gas-works supplies, repairs, &c., it is not so easy to do without the engineering and building contractor in carrying out constructional work. We believe, however, that the usefulness of the contractor is usually overrated, even for this class of work. Structural iron and steel work must, of course, be contracted for, except under extraordinary conditions which need not be discussed here; but speaking generally, most works of construction required by industrial organizations, such as gas companies, need not be "put out" in this way. When the engineer is a capable designer, and the contracts are properly prepared for competition, it will frequently be found that the contractor's profit, and the incidental expenses of having work done in this way, far exceed any possible advantages derivable under the system. The contractor has to protect himself against loss, of course; and this can only be effectually done at exorbitant cost to the client. Why not, then, dispense with the contractor in his conventional capacity as the middleman who is to make the greatest profit, or bear the loss, if any, on the job? This is what many well-managed industrial concerns are doing; and the movement constitutes, unless we are greatly mistaken, a noteworthy sign of the times. Engineers and managers of gas-works who have not yet felt this movement, may regard the idea with some apprehension, as implying an addition to their responsibilities without necessarily improving their position. This fear is groundless. An engineer who is worthy of the name, who not only knows how to design a structure to meet his own requirements, but is competent to see that it is properly made or built, as the case may be, not seldom experiences many qualms at the thought that all his plans must be committed to the tender mercies of a tradesman, whose interest lies in fulfilling his obligations in the cheapest style permitted by the terms of his specification. How much more comfortable would such a designer be if he knew that the responsible builder, the head of the executive work, would be an agent of his own, with the same interest as himself in having good work done? The idea is not that the designer or the engineer shall always necessarily also be the working head of the executive staff. On the contrary, it is usually preferable that the supervizing and the executive staff should be distinct, although the Engineer would naturally be supreme over both departments. The great point is the avoidance of the creation of the separate interest of the contractor, which may usually be secured more easily than some engineers inured to the ordinary system are apt to believe. This, as we take it, is one of the salient features of later engineering practice; and it is certainly a feature that able and conscientious engineers have no reason to find fault with.

COMMUNICATED ARTICLES.

THE PHOTOMETRIC VALUE OF THE STANDARD SPERM CANDLE.

By W. C. Young, F.I.C., F.C.S., &c.,
Gas Examiner to the Corporations of London, West Ham, Hastings, Bedford, &c.

Before the present standard of light can be replaced by a substitute, it will be absolutely necessary to decide what is the exact photometric value of the parliamentary standard sperm candle. With this object in view, I made a large number of experiments in the early part of 1891, the results of which may be acceptable at the present time.

When the sperm candle was legalized as the standard of light, the old form of Bunsen photometer was in use; and in this one candle only was employed. This was burnt as in the ordinary way for domestic lighting purposes. The experiment commenced as soon as the ends of the wicks glowed, and were slightly bent; and the candle was extinguished at the end of ten minutes. Some time later, the Letheby modification of the Bunsen photometer was very generally adopted, and continues in use to the present day. In this instrument two candles are employed; and, for a long time (in many places it is so now), the whole candles were used, one burnt from the thin end and the other from the thick end. The practice of burning the candles in this way most probably arose from Bowditch's experiments, which appeared to show that the thickness of the candle influenced the light it gave. The Gas-Works Clauses Act, 1871, is in force in most places outside the Metropolis. This Act enforces the use of an open photometer (the Letheby-Bunsen being the one generally furnished); and it provides that the candles should be extinguished at the end of ten minntes, and the consumption of sperm ascertained by the loss of weight. In most places, however, the more exact method of ascertaining the consumption of sperm by the time taken to burn 40 grains, is now adopted.

Taking all these facts into consideration, I came to the conclusion that the most impartial method of using the candle for the purposes of these experiments would be to use two; burn each from the thin end; commence each testing when the wicks glowed and were slightly bent; ascertain the consumption of sperm by the time method; and extinguish them immediately on the completion of the test. Strict cleanliness was observed throughout; but the candle wicks were never touched, or influenced in any way. As many tests as possible were taken with each pair of candles, with an interval of at least 30 minutes between each; and the candles were fixed so that the flames were on the level of the centre of the disc in each testing.

Candles A.		Candles B.		Candles C.	
Result.	Sperm Burnt in 10 min. Grains.	Result.	Sperm Burnt in 10 min. Grains.	Result.	Sperm Burnt in 10 min. Grains.
14·93	39	14·80	39	15·17	41
14·61	37·9	14·55	40·1	14·31	38·7
14·04	39	15·14	40·6	14·64	40·3
14·95	44	15·08	40·7	14·91	42
15·12	40	15·15	40·9	14·65	42
15·26	39·3	14·65	41·4	15·23	41·3
14·73	40·3	14·89	40·2	14·78	40·7
14·44	38·3	14·50	39·5	14·86	40·4
14·63	38·2	14·84	40·0	14·74	40·9
14·10	38·4	14·79	41·9	14·39	40·2
14·64	38·5	15·37	41·0	14·73	39·2
14·94	39·9	15·06	41·1	14·72	39·1
15·51	40·7	15·19	40·2	14·51	40·5
15·72	40·8	15·25	40·3	14·58	40·3
16·12	40·2	14·56	40·2	14·72	40·4
15·35	39·9	14·32	40	15·02	41
14·94	40·1	13·98	38·9	15·03	41·6
15·15	40·7	14·11	38·3	14·43	40·6
15·95	40·1	14·16	39·4	14·52	40.4
15·14	41·2	14·00	40·4	14·62	40·8
16·03	40·9	14·00	38·6	14·66	39·8
14·85	41·2			14·90	40·9
14·77	41·4			14·72	41·3
Highest . . 16·12		Highest . . 15·37		Highest . . 15·23	
Lowest . . 14·04		Lowest . . 13·98		Lowest . . 14·31	
Mean. . . 15·04		Mean. . . 14·68		Mean . . 14·73	
Check tests after the first, fourth, tenth, and fifteenth experiments gave 14·2, 14·18, 14·1, and 14·16 candles respectively.		Check tests after the sixth and tenth experiments gave 14·06 and 14·4 candles respectively.		Check tests after the first, seventh, fourteenth, nineteenth, and twenty-first experiments gave 14·24, 14·3, 14·18, 14·24, and 14·3 candles respectively.	

Candles D.		Candles E.		Candles F.	
Result.	Sperm Burnt in 10 min. Grains.	Result.	Sperm Burnt in 10 min. Grains.	Result.	Sperm Burnt in 10 min. Grains.
15·36	38·4	14·80	40	15·04	39·8
14·92	39·9	14·42	39	14·15	40·6
14·92	41·4	14·26	38·6	14·62	41·2
15·11	40·3	14·49	40·2	14·06	41·9
15·09	39·4	14·53	40·9	14·13	41
15·50	38·9	14·55	40·1	14·23	39
14·77	41·1	14·21	40·2	14·04	40
15·36	39·1	14·73	41·7	14·10	40·8
14·78	38·5	14·40	41·2	14·17	41·2
15·18	39·3	14·73	41·0	14·31	42·3
15·33	39·2	14·76	40·4	14·37	39·6
14·86	38·3	14·45	41·3	14·11	40·5
15·44	37·8	14·79	40·7	14·15	39·0
14·62	39·2	14·56	39·1	14·25	40·2
14·89	39·3	14·35	39·7	14·36	40·8
14·96	41	14·46	40	14·55	40·2
14·38	40·3	14·00	40·9	14·13	39·6
14·69	39·7	14·09	39·8	14·18	38·6
14·62	40·9	14·31	39·4	14·21	39
14·42	40·7	14·34	41·1	14·10	39·6
14·93	38·6	14·32	41	14·04	40·4
15·05	38·6	13·95	39·4	14·14	41·4
		14·01	39·1	14·62	38·9
Highest . . 15·50		Highest . . 14·80		Highest . . 15·04	
Lowest . . 14·38		Lowest . . 13·95		Lowest . . 14·04	
Mean. . . 14·91		Mean. . . 14·41		Mean . . 14·26	
Check tests after the fifth and sixteenth experiments gave 14·21 and 14·15 candles respectively.					

Mean of all the experiments = 14·67 candles.

The light used for comparison was a 2½-inch flame in the standard "London" Argand used in the Metropolis for 16-candle gas. I showed in my paper on candles read before the Society of Chemical Industry in February, 1891,* that such a flame accurately measured, with the same burner and glass chimney—the latter being placed always in the same position—gave, with common coal gas unmixed with carburetted water gas, a practically uniform light, which, tested with candles having clean, smooth, and well-bent wicks, was equal to 14·2 candles, burning 120 grains of sperm per hour. Check testings of the flame were occasionally made with candles having smooth and well-bent wicks (as described in the paper above referred to), during the progress of the experiments. The photometer employed was the last modification of the "Evans," such as is in use now at each of the City of London testing-stations, which is practically a 60-inch "Letheby," with the candles and burner protected from draughts.

The six sets of candles were all obtained from different sources, and fairly represent the candles in use at the present time; and the results show that the photometric value of the average standard sperm candle, when used as at the time of its official adoption, is equal to a little more than one-fifteenth of the light produced by an accurately measured 2½-inch flame of ordinary coal gas in a "London" Argand burner with a thin glass chimney.

It has been suggested that the sperm candles used for gas testing have much improved of late years, and give more light; and, on the other hand, that they are not so good as they used to be, and give less light. My own opinion, after using them daily for 25 years, is that they are the same now as they ever were; and I am confirmed in this by the fact that a 3-inch flame in the "London" Argand was, years ago, always considered (and spoken of) as of 16-candle power, and that an average of a large number of experiments upon carefully-measured 3-inch flames gives a value of 16·25 candles at the present time.

* See JOURNAL, Vol. LVII., p. 249.

LIGHTING.

By W. H. Y. Webber.

(*Continued from Vol.* LVIII., *p.* 1085.)

PART III.—A CRITICAL EXAMINATION OF MODERN PRACTICE.

From what has already been stated, it will be perceived how the practice of gas-lighting has been gradually developed and improved of late years with more or less direct reference to theoretical requirements. It is the principal object of the writer to show that yet greater exactitude in dealing rationally with problems of lighting may be attained, and lighting effects reduced systematically to precise quantitative expressions, so that the lighting of one locality may be exactly compared with that of another when the same system is applied in both cases, or the useful effects of different systems may be contrasted, by a simple and indisputable mathematical method. To this end it is necessary to briefly recapitulate so much of the theory of illumination as bears immediately upon the problems that occur in practice. Having done this, it will be easy to place practice upon a sound scientific footing. Clearly, the starting-point of such an attempt to rationalize lighting is a thorough grasp of all the relations of the Law of Distance. These relations will appear by the following graphic illustration.

Diagrammatic Proof of the Law of Distance.—Let Q = the quantity of illuminating power of any source of light. Draw a circle C round the source at any distance d, and draw another circle C_1 from the same centre at double this distance d_1. Mark off any part l of the inner circle, say 1 foot in length. Draw radii from the centre to each end of the length l, and produce them until they meet the outer circle C_1. The length l_1 will be double that of l. Since light radiates from a source in straight lines in all directions, the circle C may be considered further as

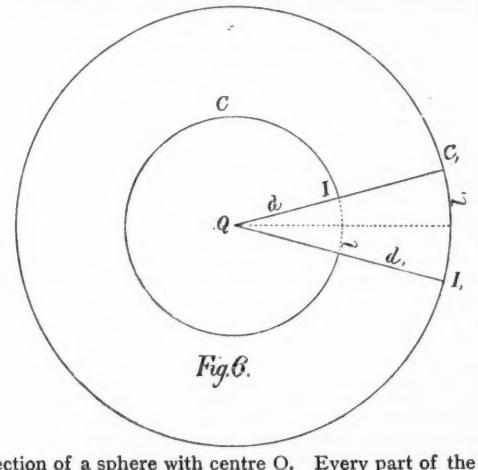


Fig. 6.

the section of a sphere with centre Q. Every part of the inner surface of this sphere with radius d will receive the same illumination from the central source. Consider further this sphere as an opaque shell, in which an opening 1 foot square is cut at l. The shell C is surrounded by a concentric shell C_1 of twice its radius; wherefore the light radiating through the opening l will mark on the inner surface of the latter an illuminated square patch, the sides of which will be double the length of the sides of the opening l_1 and therefore it will be four times its area If the area of l is 1 foot, the area of l_1 will be 4 feet; and as the

light-intensity at I has to spread at I_1 over this quadrupled area, it can only be one-fourth as bright at any point of the extended surface.

The following are the formulæ for the Law of Distances :—

(1) $$I = \frac{Q}{d^2}$$

(2) $$Q = I \times d^2$$

(3) $$d = \sqrt{\frac{Q}{I}}$$

Let Q = 64 candles; d = 2 feet; d_1 = 4 feet. Here we have for the intensity I at the distance d

$$I = \frac{64}{2^2} = \frac{64}{4} = 16 \text{ candles.}$$

Also, the intensity I_1 at the distance d_1 will be—

$$I_1 = \frac{64}{4^2} = \frac{64}{16} = 4 \text{ candles.}$$

In the second form of the equation, we are supposed to know that I = 16 candles, and that d = 2 feet. Whence, to find the power of the central source, or Q, we have—

$$Q = (16 \times 2^2) = (16 \times 4) = 64 \text{ candles.}$$

Again, knowing the value of Q and of I as being 64 candles and 16 candles respectively, we wish to find d. To put the problem in the simplest language, we may ask: At what distance must a surface be from a light-source of 64-candle power in order to receive an illumination equal to 16 candles? Here—

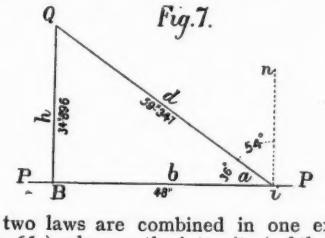
$$d = \sqrt{\frac{64}{16}} = \frac{8}{4} = 2 \text{ feet.}$$

In order to logically complete the explanation of the method of computing the diminution of the lighting effect of any source whatever, from the square of the distance from the source at which the effect is produced, it is necessary to remark that the illuminating power of the source is taken also to mean the lighting effect which it is capable of exerting at a distance *unity* from itself. Thus, if the distance is expressed in feet or inches, the initial luminous effect is supposed to be exerted at 1 foot, or 1 inch, as the case may be. (See Parkinson, Vol. LVIII., p. 664.) Unity, in short, is the understood third term of the proportional expression used in these calculations.

Thus, when we say that, according to the formula $I = \frac{Q}{d^2}$, the intensity of a light-source of 64 candles at a distance of 2 feet is equal to that of another of 16 candles, we may either mean that this is the comparative power of the lights themselves, or that a light of 64 candles at 2 feet or 2 inches distance will give the same luminous intensity upon a screen normal to its radiation as another light of 16-candle power at a distance of 1 foot or 1 inch, according to the unit of measurement employed. The former definition is the language of *photometry*; the latter, that of *lighting*.

When, going beyond computing the *intensity* of light at a point of a sphere surrounding the source, we proceed to consider the question of the *quantity* of light distributed from a source over a plane surface, which is the necessary condition of all artificial lighting, we must take into account the Law of the Cosinus as well as the Law of Distance; because, with the exception of the point in the plane situated vertically under the light, and consequently, in optical language, in the normal of the plane, all such light must fall on the plane at an angle.

Fig. 7.



Hence the two laws are combined in one expression (see Vol. LVIII., p. 664), whereby the intensity i of the lighting effect upon a point i in the plane PP (fig. 7) is—

$$i = \frac{Q}{d^2} \cos. Q\, i\, n.$$

But since the cosine of the angle $Q\, i\, n$ is equal to the sine of the angle a, which is its complement, and sin. a, by the trigonometrical definition, is the ratio $\frac{h}{d}$, we have—

$$i = \frac{Q}{d^2} \times \frac{h}{d} \text{ hence } i = \frac{Qh}{d^3}$$

Expressing this in words, we find the rule that *the intensity of the light that falls upon a point in a horizontal plane from a source above it, is determined by multiplying the illuminating power of the source by its vertical height above the plane, and dividing the product by the cube of the slant distance.* It will be noticed that this is not quite identical with Professor Robinson's rule (Vol. LVIII., p. 753), which takes the horizontal distance from the foot of a lamp-post to the spot of which the illumination is to be determined, instead of the slant distance; that is to say, it makes the intensity vary with the tangent instead of with the sine of the angle. The difference is not great in the case of lighting at a very acute angle, such as that from a street lamp at a considerable distance, because the tangents of acute angles do not greatly differ from their sines. The error increases, however, with the angle; and, in any case, it is preferable to work by a correct rule.

Since in the foregoing rule we have the lighting effect diminishing *inversely* with the square of the distance, and *directly* with the sine of the angle which the rays proceeding from the source make with the horizontal plane beneath them, there must be some common measure for both, where the maximum combined effect is exerted. In other words, if there is a small plane of unit area i (Fig. 7) situated at a certain distance b horizontally from the perpendicular passing through a light-source Q, there will be a height h at which the light-source must be fixed if the effect of the Law of Distance is to be exactly balanced by that of the Law of the Cosinus, so that the light shall be as near to the illuminated plane as is compatible with its falling upon its surface at the greatest angle.

Heath gives it as a proposition for students of Geometrical Optics to prove that this maximum effect is produced when $h = \frac{b}{\sqrt{2}}$. The mathematical proof of this statement may be attempted by any reader of these articles who thinks it necessary. It is a somewhat laborious exercise, involving the calculus, and not worth filling the space of the JOURNAL with. Let it suffice for present purposes to admit that the theorem is correct. To give the expression its value, it may be stated that when in a right-angled triangle the perpendicular $= \frac{\text{the base}}{\sqrt{2}}$, the angle a is nearly 36°.

In fig. 7 let the base b = 48 inches; the angle a being 36° as before. The height of the perpendicular h = tan. $a \times b$. In this case tan. a = 0·727, and b = 48 inches; wherefore h = 0·727 × 48 = 34·896 inches. And since the sides of triangles are proportional to the sines of the opposite angles, as sin. a : sin. B : : h : d. Sin. a = 36° = 0·588. Sin. B = sin. 90° = 1·00. Whence, as 0·588 : 1·00 : : 34·896 inches : d. = 59·347 inches.

(To be continued.)

TECHNICAL RECORD.

GAS v. STEAM ENGINES FOR MOTIVE POWER.

From time to time we have recorded the results of working with the cheap fuel gas made in the apparatus devised by Mr. J. Emerson Dowson. This gas has long been used for a great variety of industrial purposes; the largest plant being at the well-known cocoa factory of Messrs. Van Houten and Son, in Holland, where about a million cubic feet can be produced per day of ten working hours. This gas is also suitable for cooking and heating; and at the Gloucester County Asylum all the kitchen work for the staff and inmates has for a considerable time been done with it. About 300 quartern loaves are baked with it daily, at a cost of about 1s. only for fuel; and, in addition, it serves two 12-horse power engines used for pumping water, and driving a dynamo for electric lighting. At Gloucester, the cost of the gas, including fuel, wages, repairs, and all incidental expenses, is under 1½d. per 1000 cubic feet. But when made on a small scale, the average cost is from 2d. to 3d. per 1000 cubic feet; and as four volumes of this gas are required to give the same heat as one volume of ordinary lighting gas, it follows that the cost of the equivalent of 1000 feet of the latter varies from 6d. to 1s. At Messrs. Van Houten and Son's works, the equivalent cost is 6½d., with anthracite coal costing 16s. a ton.

These remarks will serve to show that, in a quiet way, the Dowson system has steadily established itself for a variety of heating purposes; but, besides this, we believe we are right in saying that about half the installations of this plant are for motive power. It is, in fact, with this branch of the subject that we now propose to deal chiefly. Messrs. Crossley Bros., Limited, frankly state in their catalogue that, when town gas costs more than 3s. per 1000 cubic feet, the working cost of a gas-engine of upwards of 14-horse power nominal exceeds that of a steam-engine under the usual conditions of working. The fuel in the form of town gas is, in fact, too dear compared with the steam coal used for a boiler. On the other hand, it has been found that the ratio of heat converted into work is higher in a gas-engine than in a steam-engine. From a practical point of view, we are thus faced with the fact that, although the gas-engine is more efficient as a heat-engine than its rival, it cannot be economically used in large sizes, unless some cheaper form of fuel than ordinary illuminating gas is available.

Mr. Dowson was, however, ready with his plant; and the results obtained with it in many places were so satisfactory, that makers of gas-engines were encouraged to design motors of much higher power than could be driven economically with ordinary gas. Messrs. Crossley, for instance, now make a double-cylinder engine which actually develops more than 160 indicated horse power when worked with Dowson gas; and there are three of these engines now in operation regularly—

GAS POWER AT THE CAMBRIAN MILLS, NEWTOWN, MONTGOMERYSHIRE.

TABLE *showing the Result of Two Trials, each of Six Days* (56 *Hours*) *with Dowson Gas, made from* [A] *Welsh Anthracite and* [B] *Ordinary Gas Coke from the Wellington Gas-Works; the Data being Furnished by the Severn Tweed Company, Limited.*

	Number of Section.	Nominal Horse Power of Crossley Engine.	Approximate Maximum Brake Horse Power of Engine.	Approximate Brake Horse Power used for Machines and Shafting during Trial.	Brake Horse Power Hours during Trial.	Fuel Consumed.			Cost of Fuel.			Remarks.
						For Generator.	Slack for Boiler.	Total per Brake Horse Power per Hour.	Anthracite per Ton.	Slack per Ton.	Total per Brake Horse Power per Hour.	
						lbs.	lbs.	lbs.	s. d.	s. d.	d.	
A	1 and 4	60	128	96·03	5377·75	13,416	336	1·23	19 10	9 6	0·130	The boiler was partly fired with anthracite cinders, &c., which fell through the generator grate bars.
	2	40	73	72·39	4054·00							
	3	40	73	27·00	1515·25							
	Hoists	4	5½	3·57	200·00							
		144	279½	198·99	11147·00							
B	1 and 4	60	128	89·46	5010·00	16,645	1568	1·73	Coke. 15 0	9 6	0·135	The coke was not of good quality. There was no residue from the coke in the generator, which could be used in the boiler.
	2	40	73	66·12	3702·72							
	3	40	73	28·49	1595·44							
	Hoists	4	5½	3·57	200·00							
		144	279½	187·64	10508·16							

Machines used in, and Horse Power Required for each Section.

Section No. 1.		Section No. 2.		Section No. 3.		Section No. 4.	
Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.
Blackman fan . . .	2·50	6 twisting machines .	18·00	40 fast looms . . .	19·00	5 fulling-machines .	15·00
Wool-drying machine .	3·25	12 mules	24·00	47 slow „ . . .	8·00	3 washing „ .	3·00
Shaker	0·50	Warp hank-machine.	1·00	4 Sowden looms .	0·50	2 hydros.	1·00
Burring-machine . .	3·50	Reel „ „ .	1·00	6 Bradford „ . .	0·50	Wool-scourer . . .	3·00
New Willey	2·00	5 sets of carding-machines	30·00	4 winding-machines	4·00	Stocks	0·50
Old „	2·00	Shafting, &c. . . .	6·00	Shafting	8·00	Shearing-machine, &c.	5·00
Garnet-machine . .	1·25					Tenter „ .	6·00
8 sets carding-engines.	48·00					Shafting, &c. . . .	4·00
2 „ waste „ .	4·00						
6 mules	12·00						
Shafting, &c. . . .	6·00						

one at the engineering works of the Projectile Company, Limited, at Wandsworth; one at the flour-mills of Messrs. Mead and Son, of Chelsea; and one at the cloth-mill of the Severn Tweed Company, Limited, Newtown, Montgomeryshire. At Wandsworth, there are also two other Crossley engines, each of 80 indicated horse power; and at Newtown there are three additional large engines. It will thus be seen that a new departure has been made in gas power, and that large engines driven by it are now fairly in competition with steam-engines.

It remains to be seen what is the economical result. Fortunately, we have the means of gauging this, as the Severn Tweed Company have lately made independent trials to ascertain the weight and cost of fuel consumed. The details of these trials are given in the tables, with a list of machines in each department. In experiments marked A, the gas-generator was fed with anthracite; in those grouped under B, ordinary gas coke was employed. At the time the trials were made, the mill was not in full work; and the aggregate brake or effective power used was about 190-horse power, while the engines are capable of developing a total of about 280-horse power effective. The friction of the engines was, therefore, greater in proportion to the work done than would have been the case if they had been fully loaded; but we do not look upon this as an exceptional condition in average mill work. Attention is drawn to it merely to show that in the trials referred to the engines were not at all favoured.

The general outcome of the trials is that, when anthracite was used in the generator, the total fuel consumed was only 1·23 lbs. per brake horse power per hour; and allowing 20 per cent. for the average friction of the engines, the consumption was barely 1 lb. per indicated horse power per hour. The price of anthracite is now high; but, even at 20s. per ton, the total fuel works out to only 0·13d. per brake horse power per hour. In the trial with gas coke, it is stated that the latter was rather inferior in quality, and produced much clinker and ash. Even with this, the total consumption was at the rate of only 1·73 lbs. per brake horse power, or about 1·4 lbs. per indicated horse power per hour. The coke cost 15s. per ton delivered at Newtown; and at this rate the cost per brake horse power per hour was 0·135d. It will thus be seen that even coke at 15s. a ton can compete with the best anthracite. But at 10s. a ton the cost would be 0·09d., and at 5s. per ton, only 0·045d. per brake horse power per hour.

These are, no doubt, remarkable results; and, seeing that the trials referred to were made under thoroughly practical conditions of working, one may hope that, as the use of gas power under the new system extends, a new demand for coke will be created. Mr. Dowson has, however, drawn attention to some practical points connected with the use of this residual, which gas companies will do well to consider. In the first place, the coke used in the gas-generator must be of fairly good quality, as much clinker interferes with the proper working of the plant. If there is much sulphur, it nearly all assumes the form of sulphuretted hydrogen; and this is not only injurious to metals, but the smell from it, when gas escapes during the feeding of the generator, &c., causes a nuisance. On the other hand, the coke for the generator should not be large—pieces about ¾ inch to 1 inch cube being best. If, therefore, the consumer is obliged to buy large coke, he must break it to the size required. A further important point is that the consumer should be able to buy suitable coke at something like the local price of the slack used for steam-boilers; otherwise the saving in weight of fuel in the gas system will be all, or nearly all, lost in the increased cost of fuel. To meet all these points, Mr. Dowson suggests that the small coke of the gas-works yard should be washed to remove dirt, small coal, and other impurities; and he is of opinion that when so treated, it could be sold with a good profit at about the price of local steam coal. In London and other important centres there are already, we believe, several users of anthracite who would gladly adopt coke if it could be obtained of suitable size and quality, and if the price were reasonable. It may be said that there is not yet a sufficient demand for this class of coke; but if the gas-engine makers hold back because of the cost of anthracite and coke, and if the gas companies do not display some endeavour to meet the difficulty, the extension of gas power will necessarily be much slower than it should be, now that a good practical start has been made. A new field of enterprise is opening up; and to a great extent it seems to depend on the gas companies whether or not it shall be cultivated with energy.

Sugg's "Gas Engineer's Pocket Almanac and Lighting Table" for the present year contains, in addition to full particulars of the gas-testing apparatus and other gas appliances with which the name is associated, a number of tables to which a gas manager will find it instructive to refer. Provision is made for recording monthly working results, and general memoranda.

New Companies and Issues in the Past Year.—Although the number of new companies registered last year, and the amount of new capital offered for subscription, were less than in 1890, there were 2436 additional joint-stock undertakings promoted; the aggregate capital of which reached £124,231,000. In the previous year the number was 2478; the total capital being £216,554,000. The largest number of companies registered in 1891 was in April; the amount of capital concerned being £16,931,000, of which a sum of £2,000,000 was contributed by the Water and Gas Works Securities Corporation. To show the extent of joint-stock enterprise, it may be added that since the adoption of the limited liability principle in 1862, nearly 39,000 companies, with capitals amounting to £4,040,000,000, have been registered.

THE DESSAU CENTRAL ELECTRIC LIGHTING STATION OF THE GERMAN CONTINENTAL GAS COMPANY.

Progress of the Undertaking from 1886 to 1891.

In the JOURNAL for Nov. 10 last, we noticed, among the "Electric Lighting Memoranda," a volume of reports in connection with electric lighting matters presented at a conference of German Municipal Administrators held during the continuance of the Frankfort Electrical Exhibition. Special attention was called to the report on the central lighting station of the German Continental Gas Company at Dessau, by the General Director of the Company (Herr W. von Oechelhäuser). This report has been printed separately; and, in view of the interest attaching to the question dealt with—the supply of electric light on a large scale by a Gas Company—we had the appended translation of the document prepared. We are indebted to Herr Oechelhäuser for the use of the original blocks illustrating his report; and, for the assistance of those of our readers who are not acquainted with the German language, we give the English equivalents for the descriptive particulars which appear thereon.

In accordance with a supplementary regulation of March 12, 1879, the German Continental Gas Company extended their sphere of operations to the business of electric lighting; and the first central electric station of the Company was opened in Dessau on Sept. 13, 1886. With the exception of the Berlin central stations, this was the oldest in Germany. The project arose in the first place from the idea that the application of gas-engines as a motive force in electrical central stations of moderate magnitude, was the natural link connecting gas and electricity, inasmuch as, under such conditions, the electric light appears merely as a transmuted force or as a mechanical transformation of the heat of combustion of the gas; and, secondly, from the consideration that a very important future was in store for gaseous fuel, and especially coal gas, as a producer of power, even in engines of larger size—this being the inference to be drawn from all researches on the theory of heat and from practical experience during the last decade.

DESCRIPTION OF THE INSTALLATION.

The Allgemeinen Elektricitäts-Gesellschaft (General Electric Company) and Messrs. Siemens and Halske, of Berlin, executed the electro-technical portion; the Berlin-Anhaltischen Maschinenbau-Actien-Gesellschaft (Berlin and Anhalt Machine Construction Company) put up the engines and carried out the arrangements for transmission. Since the opening, the works have been under the direction of Herr H. Roscher, the Engineer. The motive-power plant, which at the present time has undergone considerable alteration, formerly consisted of two double-cylinder "Otto" gas-engines, each of 60-horse power, one similar engine of 30-horse power, and one single-cylinder engine of 8-horse power; making a total of 158, or (say) 160 effective horse power. The gas-engines were connected by belting and throw-off couplings with the four dynamos of suitable size. The 8-horse power engine, ordinarily assumed as of 10-horse-power effective, was employed for lighting requirements during the daytime, and to start the larger engines.

For cooling purposes, the gas-engines were all connected with three intercommunicating wrought-iron air-cooling chambers, having a total surface of 100 square metres (119·6 square yards); an injector, actuated by the town water supply, being interposed between the cooling chambers and the gas-engines, to overcome the considerable frictional resistance in the cooling channels, and to regulate, as desired, the circulation and the temperature. A small pump with a 1-horse power electromotor serves as a reserve for the water supply. The average annual consumption of water by the engines was diminished to from 23 to 24 litres (5 to 5¼ gallons) per horse power per hour by the air-cooler; while with new and improved cooling arrangements further economies in working can, no doubt, be effected. Besides, we wish to point out here that the quantity of water stated above includes the by no means inconsiderable consumption in the dynamo department.

By means of a simple arrangement, the result of numerous experiments, the explosion of the gas-engines has been rendered completely noiseless; so that anyone standing outside the engine-house can scarcely distinguish by the sound whether or not the engines are in action; a white, odourless cloud of steam being the only indication of the working of the engines.

The Dynamo Machines.—At the opening of the station there were: Two of Edison's dynamos, each of 35,000 watts, one of 23,000 watts, and one of 5,000 watts—total, 98,000 watts. The dynamos work at a tension of 110 volts. After establishing a more powerful battery of accumulators in 1889, the two larger dynamo machines had to be exchanged for one with higher tension (140 volts). The increase in efficiency with this new dynamo of 45,000 watts, as compared with the 35,000 watts of its predecessors, represents approximately the loss in the accumulators. At the present time, therefore, the efficiency of all the dynamos amounts to 108,000 watts.

Distribution of the Electricity.—The scheme of the Allgemeinen Electricitäts-Gesellschaft in vogue at the time was introduced, and was arranged for a double system of conductors; but a third system can also be added subsequently. There are at present 3451 metres (about 3774 yards) of double conductors—in fact, Messrs. Siemens and Halske's lead cables protected with iron banding.

The Accumulator Installation.—In 1887 a small battery for 100 lamps came into use, and was charged by means of the small 8-horse power gas-engine; and, notwithstanding its small duty (amounting to only about 50 per cent.), and its rapid deterioration, it demonstrated so decisively the advantage of accumulators in various directions, that in the summer of 1889 the old and small battery was replaced by a larger Tudor accumulator battery (by Messrs. Müller and Einbeck, of Hagen, in Westphalia) of a capacity of 1700 ampères per hour. The new battery is arranged parallel to the dynamo machines, requires the full power of two 60-horse power engines to charge it, and can supply 600 lamps for five or six hours. The introduction of this battery of accumulators increased the total amount of capital expended on the station by 15 per cent., and its producing capacity by about 38 per cent.; and it is only since this introduction that the working of the station can be regarded as normal, economical, and certain. The economical duty of the battery (carefully recorded by two Aron watt-meters) during the year 1890 was as follows: January, 75 per cent.; February, 86 per cent.; March, 70 per cent.; April, 80 per cent.; May, 74 per cent.; June, 79 per cent.; July, 76 per cent.; August, 70 per cent.; September, 77·5 per cent.; October, 92·8 per cent. (probably an error in reading); November, 72·2 per cent.; December, 77 per cent.—averaging for the year, 78·9 per cent.

The progress in the duty of the preceding and present installations is as follows: The small battery of accumulators gave a duty of 40 per cent. in 1887 and 52 per cent. in 1888; the larger one, 78·8 per cent. in 1889 and 78·9 per cent. in 1890. In making use of these numbers, however, the error is ordinarily committed of debiting the total annual production of such a central station with the 20 to 25 per cent. loss of energy of the accumulators. This is by no means just, inasmuch as the percentage of loss for the year is also far more dependent on the proportion that the magnitude of the accumulator battery bears to the total engine capacity. In Dessau, for example the accumulators use up 52 per cent. of the twelve months' consumption; therefore the loss of 21 per cent. can only be considered on this percentage, so that the loss by the accumulators only amounts to 10 or 11 per cent. of the whole year's consumption. The new battery has been in continuous operation for nearly two years without any interruption; and it has been at various times surcharged to the extent of 20 or 25 per cent. without suffering any damage.

The acknowledged advantages of accumulator installations have been confirmed to the following extent in the Dessau works:—

1. Sudden variation in light and pressure, due to changes in consumption and to the pulsations of the engine, are avoided. These drawbacks are comparatively more violent and more sudden in small and medium-sized installations than in larger central stations, owing to the total number of lights in use being smaller in the former cases.

2. In case the driving-engines break down suddenly, a portion of the consumption (for example, in the theatre, &c.) can be sustained for a long time from the accumulators.

3. The working of the engines having been more efficient, the following savings have been effected per horse-power-hour: (*a*) The gas consumption in the engines was reduced from an annual average of 920 litres in 1888 to 750 litres in 1890; (*b*) the consumption of water for cooling, from 62·6 to 23·7 litres; (*c*) the consumption of oil, from 19·9 to 9·8 grammes.

4. Large gas-engines can be set going by the dynamos by means of the current taken from the accumulators; consequently, the erection and working of special machinery and transmission appliances for starting can be dispensed with.

5. The supply of electric current can be continuously sustained at all times, day and night; and night labour can be saved.

WORKING RESULTS.

The people at present employed at the central electric station are the engineer-in-chief, an assistant, two mechanics, one fitter, and one labourer. The capital expenditure has increased from 219,952 marks on Dec. 31, 1886, to 240,660 marks on Dec. 31, 1890. So that at the close of 1890, with 3689 lamps installed, the cost per lamp was about 65 marks. Of the 3689 incandescent lamps installed, only quite an exceptionally small proportion (about 60 per cent.) have been burning at the same time. The capital expenditure in future will, however, be very considerably diminished, on account of the cost of gas-engines of 100-horse power which are now to be obtained, and also by a more advantageous arrangement of the machinery. The expenses of first establishment comprise: Buildings, 1·0 per cent.; engines and dynamos, 12·5 per cent.; accumulators, 10 per cent; boxes, cables, gas and water conduits, 3 per cent.

Up to the present time the most economical application of the gas-engines has been charging the accumulators for one hour's burning of the 16-candle incandescent lamps with a consumption of 68 litres of gas; while, according to the above table, a consumption of 100·52 litres was the annual average required for one hour's burning of the lamps when the loss in the accumulators and in the distribution was included. Nevertheless,

THE DESSAU CENTRAL ELECTRIC LIGHTING STATION.

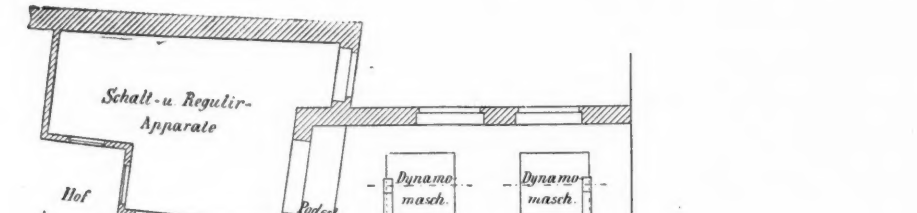


FIG. 1.—PLAN OF THE STATION AS IN 1886.

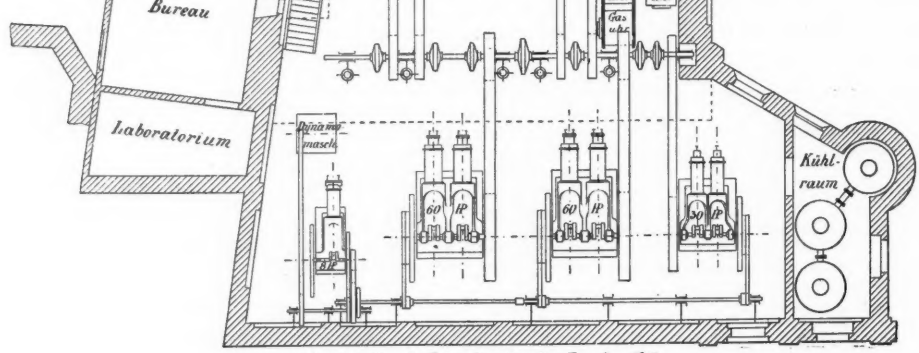


FIG. 2.—PLAN OF THE STATION AS IN 1891.

Schalt und Regulir Apparate—Switch and Regulator Plant. Hof darunter Akkumulatorenraum—Yard with Accumulator Room below. Bureau—Office. Laboratorium—Laboratory. Podest—Supervisor's Platform. Dynamomasch—Dynamos. Gasuhr—Gas-Meters. Kühlraum—Condensers. Zentrifuge—Centrifugal.

the two sets of numbers do not admit of direct comparison, because the first are not yearly averages, whereas the latter are.

Resumé of Some Working Factors.

	1886. (3mos.)	1887.	1888.	1889.	1890.
1. Number of lamps installed—					
(*a*). Incandescent lamps of various sizes	1,014	2,027	2,064	3,094	3,194
(*b*). Arc lamps	4	27	48	56	59
a and *b* reduced to terms of 16 candle power	1,076	2,400	2,544	3,565	3,689
2. Ampère-hours of current sold	62,827	195,547	243,670	333,380	367,135
3. Annual consumption of gas	27,754	54,189	60,020	68,733	67,099
4. Average annual requirements per horse power—					
Gas . . . . . litres	..	953	920·60	800	750
Water (including cooling in the dynamo department) . litres	..	..	62·60	33·70	23·70
Lubricating material grammes	..	43·60	19·90	13·50	9·80
5. Gas consumed per hour's burning of the glow lamps of 16-candle power, at 55 watts (including the total loss of production and electrical distribution)	..	152·40	131·37	113·39	100·52

The average number of hours' burning of the whole of the lamps installed is only 181, on account of the comparatively large quantity of lamps which are very seldom used (those in the Ducal Castle at Dessau); but for private lighting the number is 264 hours per annum. These figures are obtained by dividing the hourly consumption of the total lamps or of the private lamps into the total annual supply in ampère-hours. The hours of burning for gas-lights, calculated in a similar manner, reckoning 180 litres per 16-candle power, amounts in Dessau to 437 hours; or, reckoning 156 litres per 16-candle power, to 534 hours. The smaller number of hours of the electric as compared with the gas lights is accounted for by the fact that the majority of the private consumers use both kinds of lights; that in small towns, even the best consumers (shopkeepers and *restaurateurs*) do not burn lights as long as in large towns; and that a specially good class of utilizers of electricity —viz., banks and large mercantile houses—only exist to a very limited extent in many smaller places. Finally, the facility with which the electric light is turned on and extinguished, coupled in winter with the want of heating power in it, contributes to diminishing the number of hours' burning. This small annual average burning of the lights, which, as regards electric light, cannot be raised much higher in a considerable number of small and medium-sized towns, is the chief source of the hitherto bad financial result obtained at Dessau. The number of hours' burning constitutes one of the chief factors for making things pay; and therefore, with additional hours, increased dividends will accrue.*

Alteration of the Central Station.

When the introduction of accumulators had been proved to be a success, a change became necessary in the mode of working the central station, and also certain alterations in the arrangement of the machinery, which would not otherwise have been contemplated. Formerly, without accumulators, it was thought necessary to adjust the size of the engine to the supply—small engines for a small supply, large ones for a large supply—so that they should always be worked to their full extent; for running a large engine for a small amount of work, as might be expected, was *a priori* anything but economical in gas consumption, &c. Therefore, whereas the original Dessau installation had 10, 30, and 60 horse power engines and dynamos with the accumulators, the need for small and medium-sized engines disappeared, inasmuch as a limited supply can more advantageously be furnished entirely by accumulators without any engine working, or the lack of load required to work the engines fully is compensated for by using it for charging the accumulators. For in spite of the loss of about 21 per cent. in the accumulators, large motors act more beneficially arranged parallel with them, than the smaller engines without any accumulators working directly on to the distributing cables, because, in the first place, large engines require 25 to 30 per cent. less gas per effective horse power than small ones; and, secondly, on account of the parallel arrangement with the accumulators, they always run with a full load, while smaller engines, notwithstanding their adaptability in size, are only seldom fully utilized in direct working. The large motors and their full load, therefore, not only compensate for the loss in the accumulators, but lead, as is shown by the statistics given above, even to an increased working economy in various directions, and also offer many other advantages.

The importance of working engines with a full load, which is equally true of steam as of gas engines, should be demonstrated more strikingly in operating central electric stations than in other works. In the latter, one is very seldom in a position, on account of incidental charges, to compare the actual load with the simultaneous consumption of fuel; whereas, in central stations, accurate electrical measuring implements can at all times give a record of the behaviour of the engines while at work. In this direction, and for the reason that such observations must attract more attention in future, the English have, at the suggestion of Mr. Crompton, gone so far as to introduce a special expression for this purpose—namely, "load factor." It therefore follows quite naturally, with the Dessau central station in actual working, that, after the installation of the accumulators, the 8 and 30 horse power engines were seldom worked, and, in fact, not as formerly during periods of slackness, but when at certain hours the maximum output of the 60-horse power engine and the accumulators combined was insufficient to meet the demand. Then four engines and the accumulators had to be worked simultaneously. While, in the year 1886, gas-engines of only 60-horse power efficiency were generally known, at the present time twin engines are built of 120 to 140 effective horse power. Therefore it is possible to replace three engines of 60, 30, and 10-horse power by a single one of 120-horse power, which not only yields 20-horse power more, but occupies considerably less space, and needs (per horse power) less gas, lubricating material, as well as attention. Moreover, besides the increase in size, gas-engines are now constructed of such form as to permit of even single-cylinder ones being coupled directly with the dynamo; hence apart from the gain in space, transmission by belts, ropes, complicated couplings, and incidental loss of power, will be done away with in the future. Finally, it has to be remembered that, with the use of accumulators, a starting-engine is no longer required by the large gas-engines, inasmuch as the latter can be turned in the right direction by the dynamos with the aid of the current from the accumulator. The Superintendent of the central station (Herr Roscher) has since 1890 planned an arrangement of this kind in a very simple manner; and has succeeded in abolishing not merely the starting-engines, but also the starting transmission arrangements for the large engines.

In accordance with these considerations, the alterations of the central station were carried out during the current year as shown in fig. 2. The 3 and 30 horse, and one of the 60-horse power engines were replaced by a new Deutz engine of 120-horse power, coupled directly with a dynamo having a maximum duty of 80,000 watts. The dynamo put up in 1889 to charge the accumulators, was placed near the remaining 60-horse power engine, and is driven by some of the old transmission fittings. A comparison of figs. 1 and 2 will show distinctly, among other things, the saving of room, and the great simplification of the whole plan. It is scarcely necessary to point out that the irregularity of the ground plan is occasioned by local circumstances.

When the installation of accumulators becomes enlarged in sympathy with the demand, so that the entire power of the new 120-horse power engine will be needed for the complete charging, the 60-horse engine will, as heretofore, be set to work to help the operation; while during the evening the new engine will run simultaneously for the accumulators and direct on the distributing cables. Consequently, instead of three, only one fully-loaded engine, and only two instead of four engines have to be worked. It has, moreover, been demonstrated that the loading capacity of the present battery is considerably greater than 60-horse power; so that even the 120-horse power engine can transfer about 75-horse power to the accumulators. The saving of gas shown by charging the accumulators from the 120-horse power motor with a load of about 75-horse power, compared with the fully-loaded 60-horse power, will ultimately be utilized during the day for charging the accumulators by the 120-horse power engine alone.

This complete re-organization, which will be carried out with gas-engines in other large central stations of the Company permits not only of a considerable saving of space, but also furnishes the possibility of a further important enlargement on the same piece of ground, which is very favourably situated, being in the midst of the town, and in the immediate vicinity of the Ducal Court and Theatre, which is illuminated by the electric light. It likewise encourages the anticipation of still more important working results for the future.

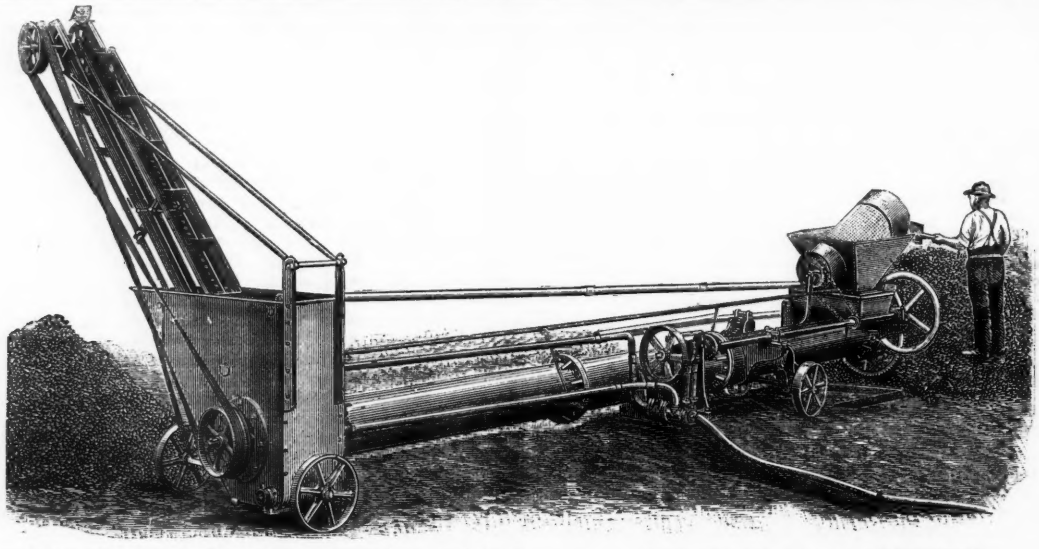
(To be continued.)

GREENWAY'S SAND WASHING AND ELEVATING MACHINE.

In the course of the letter by "Inspector," in last week's number of the JOURNAL, dealing with the storeage and mechanical filtration of water, reference was made, in connection with the latter subject, to the necessity for some means of promptly and efficiently cleansing the sand or other medium employed in the filter, upon which, as then pointed out, the whole secret of the success of the process depends. It may therefore be opportune to direct attention to the sand washing and elevating machine shown in the accompanying illustration, which has been constructed in accordance with Mr. Greenway's patent, the licensees for which are Messrs. James Gibb and Co., of 99, Fenchurch Street.

In the illustration on next page, the machine is shown attached to a water motor, by which it may be driven where sufficient pressure is available; but it can, of course, be fitted with a small steam-engine. When the former power is used, the water

* Taking the annual average of the twelve gas stations of the German Continental Gas Company, the average hours' burning is 506; the minimum one town being 341, and the maximum 580.



is conveyed from the main to the motor by hose pipe; and the exhaust water, after passing through the motor, is carried into the discharge-tank of the machine. Thence it flows by gravitation along the large pipe at the bottom, meeting the sand, which is being forced along this pipe, by a series of paddle blades on a shaft, from the feeding end of the machine. These blades thoroughly churn up the sand; and by the time it reaches the tank, it is perfectly clean, and is lifted out by an elevator, consisting of a series of steel buckets having perforated bottoms (to allow of the water draining away), and dropped in a heap alongside the machine—the dirty water overflowing into a catch-tank, and being carried away by hose pipes or into a catch-pit. With one passage through the machine, the sand is delivered thoroughly and uniformly clean, which, as is well known, is not generally the case with hand-washing. Large stones or other refuse that may be with the sand are screened out; and thus the blades are preserved from damage. The screw-shaft bearings are kept perfectly free from grit by small jets of water, under pressure, admitted into them—effectually preventing them from wearing away. Being mounted upon wheels, the machine can be run up to the sand, which it will deal with and discharge either to the right or to the left, until the heap is 8 or 9 feet high, when it can be moved. With the assistance of this appliance, one man is able to wash from 1½ to 2 yards of sand per hour at a cost for labour very considerably less than with the old system of hand-washing. Where a water motor is attached, the power is supplied at practically no cost, seeing that the exhaust water is utilized in the washing of the sand.

A New Lead Paint.—*Le Génie Civil* describes a method of making a lead paint. About 5 litres of cotton-seed oil are placed in a suitable metal vessel, and into this is poured about 10 kilos. of molten lead at a temperature of 335° C. The lead is poured in slowly, a little at a time, and the mixture is kept constantly stirred. When the operation is complete, and the oil has cooled down, it will be found that about 1½ kilos. will have been taken up and held in solution by the oil. The operation is then repeated as often as required; it being found that 5 litres of oil will take up about 5 kilos. of lead after five repetitions of the treatment. The result is a liquid about as thick as varnish, which will adhere very strongly to any materials, more especially to metals, and is a valuable vehicle for protecting iron or steel against rust in sea water.

Liberty and Property Defence League.—This League, which was established about nine years ago, with the object of maintaining freedom of contract, upholding proprietary rights, and resisting Socialistic legislation, has issued its report for the past year. The need of such an organization is shown by the increased number of applications made to its Parliamentary Committee by the Defence Societies of various interests, and by owners of property of all kinds, for co-operation in resisting the legislation by which they are in turn severally assailed. In addition to the delivery of lectures and the holding of public meetings, the League do a great deal of good work by the distribution of pamphlets and leaflets, for which there is a growing demand. In the past twelve months, no less than 105,533 publications were printed and issued. With regard to the League's work in the coming session, the report states that a Bill has been drafted which will have for its object to restore to ratepayers the control over expenditure by municipal corporations in promoting or opposing Bills in Parliament, which was taken from them by section 15 of the Local Government Act of 1888, by which their sanction to such expenditure is dispensed with. The Council of the League is composed of gentlemen well known in political, scientific, and financial circles; and they have the Earl of Wemyss for their Chairman. The Secretary is Mr. W. C. Crofts; and the offices are at 7, Victoria Street, Westminster, S.W.

REGISTER OF PATENTS.

Production of Coke.—Jones, F. J., of Bradford. No. 19,501; Nov. 29, 1890. [8d.]

This invention relates to improvements in the process of making coke described in patent No. 11,920 of 1889. In the process then explained, the coking of the coal is effected by the passage transversely, through a thin vertical stratum of coal, of the hot gases resulting from the combustion of producer gas generated in a separate gas-producer furnace. The coke so produced is, however, liable to be contaminated by the volatilizable impurities—particularly the sulphur—contained in the fuel consumed in the furnace, while the gases resulting from the coking operation are virtually wasted.

The present improvement, therefore, is designed both to avoid this contamination with sulphur and to utilize the gases resulting from the coking operation. With this object the gases given off are first purified, and then reheated; and in this condition are used for the purpose of continuing the coking operation, either on the same or a different charge, and simultaneously sweeping out the impurities contained in the charge. By purifying the gases and using them in this way, it is claimed that a much purer coke will be produced than when crude gases from the producer furnace are employed, and the ammonia, sulphur, and other valuable bye-products may be recovered. As the gases given off in the operation of coking a charge are more than sufficient to enable the operation to be repeated on another charge, the producer gases need only be used for coking at starting—that is to say, for the purpose of coking the charge in the first oven (or first pair of ovens) of a series. The coking of the charges in the succeeding ovens of the series is effected by the gases (purified and reheated) coming from the ovens already at work, and so on; the timing of the heats and of the intermediate operations being so arranged as to make the cycle of operations continuous through the whole series of ovens. The principal use of the producer in all the coking operations after the first is, therefore, to reheat the gases after purification and prior to their re-use for repeating the coking operation; the gases used being theoretically everlasting, and simply alternating in composition from carbon dioxide to a rich gas consisting largely of carbonic oxide, and back again to a gas consisting of carbon dioxide, and so on. In each complete cycle, the carbon dioxide made in the combustion chamber becomes changed in passing through the hot coking mass; the gases becoming highly charged with tarry vapours, ammonia, and other gaseous constituents. The reheating of the gases might, therefore, be effected without admixture with the producer gases, which would in that case only be passed through the first charge of coal. But in practice it is preferred that the gases after purification should be reheated by being mixed with the gases from the gas-producer; and to avoid contamination of the gases with impurities contained in the fuel, the producer is fed with the breeze resulting from a previous charge, which, having been coked by this process, will be pure.

The apparatus for this process consists of any number of pairs of ovens; each pair being situated between a combustion chamber on the one side and a gas-collecting chamber on the other. The chambers are common to the two ovens of a pair, which communicate with them by orifices in the division-walls. Each combustion chamber is preferably placed between two pairs of ovens, and is common to both pairs. Each oven is a long narrow upright chamber of approximately equal length and height, but of a breadth of only about one-tenth the height; the roof and floor being inclined at a pitch of (say) about 35°. The most important dimension is the breadth, which is governed by the permeability of the mass by the gases of combustion; this being in turn dependent on the kind of coal and size of the pieces. The inventor finds that 14 inches is a good working dimension for the average breadth of the oven for coking "smudge" or "duff," or 18 inches for coking rough slack. The sides of the oven should not, however, be quite parallel, but slightly wider apart at the front of the oven, to facilitate drawing the charge. The orifices in the walls are of such size that they will not be choked by the coal, and may be made either by using perforated fire-clay lumps, or by leaving open (to the extent of about ¼ inch) all the vertical joints of the brickwork of the side-walls from the floor up to the shoulder, above which the brickwork is solid; these perforated walls being prevented from bulging by headers or cross-ties of fire-brick crossing the chambers, and binding their opposite

walls together. The opposite side-walls of the ovens being thus perforated over practically the whole area of the charge, the products of combustion in passing to the gas-collecting chamber will cross the ovens, and be uniformly distributed through the whole mass of coal contained therein, and be caused to traverse in the direction of its least thickness.

The ovens of each pair are set back to back, or with their higher and narrower ends together; and each pair has a charging-mouth, closed by a cover, and common to the two ovens. The cross-division wall between the inner ends of the ovens is only high enough to separate the masses of coke, without interfering with the free charging of both ovens from the one mouth. In order to enable the coke to be discharged *en bloc*, and with little waste of labour, each oven floor is inclined downwards towards the front end, where is situated the discharging aperture, extending the full width and height of the oven, and closed by sand-luted doors. The downward inclination of the floor is continued outside the oven, to enable the mass of coke to be slid out with little or no breakage. The perforated side-walls of the ovens (especially when a shrinking coal is intended to be used) have each a ledge or shoulder about 2 inches in width, inclined at a slightly greater pitch than the floor, and situated at such a height that a sufficiency of the charge (which fills the oven nearly to the roof) will rest on the shoulders, and seal the passage left by the contraction in bulk of the coal in coking. This prevents the gases of combustion from passing round, instead of through, the charge towards the end of the coking operation. In order to ensure adequate heating of the lower part of the charge, the space beneath the floor (which is of fire-brick) may communicate with the lower part of the combustion chamber by orifices. The gas-producer furnace communicates with the several combustion chambers by a flue (provided with valves) of fire-brick, for controlling the passage of the furnace gases to the combustion chambers. The furnace also has air-heating flues, through which the air supplied to the combustion chambers passes.

Igniting and Starting Arrangements of Gas-Engines.—Lanchester, F. W., of Bedford Row, Holborn, London. No. 19,513; Dec. 1, 1890. [8d.]

This invention, relating to the igniting and starting arrangements of gas-engines, is applicable to incandescent tube or incandescent metallic surface igniters; and one object is to dispense with continuous external heating for such igniters, and to cause the temperature of the ports and passages leading to the tubes to be more uniform under variation of load. Another part of the invention refers to an arrangement for igniting the charge and starting gas-engines such as are described in patent No. 19,868 of 1889.

In carrying the first part of the invention into effect, communication is made between the explosion space and a small chamber by a tube controlled by any suitable valve; and opposite the end of the tube which passes into, or projects into, this chamber is arranged a plate of platinum, or other suitable material, to be first heated to incandescence by a flame. When the engine is at work, a portion of combustible mixture is allowed to pass through the tube at every compression stroke; and the current entering the chamber impinges against the incandescent metal, and becomes ignited. The flame so produced further heats the already incandescent metal, and keeps it at a temperature suitable for ignition, without requiring any application of an external flame. The bore of the tube (or a portion of it) is so proportioned that, when the chamber is being filled with gases from the cylinder, the velocity of flow is sufficient to prevent the flame passing back to the cylinder; but when the chamber fills sufficiently to reduce this velocity to a certain rate, the flame at once passes back to the engine cylinder, and explodes the mixture contained therein.

In order to keep up a supply of sufficient combustible mixture or flame to maintain the metal or other surface incandescent, the engine is governed by preventing the flame passing back to the cylinder, and alternately expanding and compressing the mixture in the cylinder without exploding it—allowing, however, a sufficient portion of inflammable mixture to impinge against the hot surface to keep it incandescent. With this object, the governor acts on a valve, which so closes or reduces the passage between the cylinder and the chamber that, although the mixture fires in the small chamber and so heats the surfaces, yet the flame which is the result of the ignition cannot pass into the cylinder.

In starting a compression gas-engine with positively actuated valves, or with an automatic or other gas and air inlet-valve, in accordance with the second part of this invention, a passage is provided between the compression space near the inlet-valve and a port nearer the forward extreme of the piston stroke. The port is covered by the piston when it is full in; and as the piston moves out to take in a charge of gas and air, a second passage (leading back to the air and gas inlet-port, from one end of the front port) allows a portion of the gas and air drawn into the engine to pass into the port, and fill the passage leading to the compression space. The second passage is controlled by a check or flap valve, opening into the front port with but slight resistance. Another flap or check valve opens from the atmosphere into the front port, but is loaded by a weight or spring sufficiently to keep it shut with the amount of "suction" which opens the first-mentioned check-valve. This second check-valve has a flame playing against it or near it from the atmosphere.

The arrangement acts as follows: When the piston moves from the in-end of its stroke to take in a charge of gas and air, the mixture passes into the cylinder by the first and second passages through the front port as well as by the main inlet-valve. The "suck," however, is at first insufficient to open the second or external flap-valve; but when the piston has moved sufficiently to uncover the front port, then, as it enters directly to the cylinder, the "suction" increases very much, and the outer valve opens so that the flame is introduced and ignites the mixture in the cylinder. This gives the piston an impulse at low pressure; and the low-pressure impulse is repeated at every revolution till the engine has attained its speed. Then the igniting-starting arrangement is shut off by a suitable cock or valve; and the ordinary compression ignitions proceed.

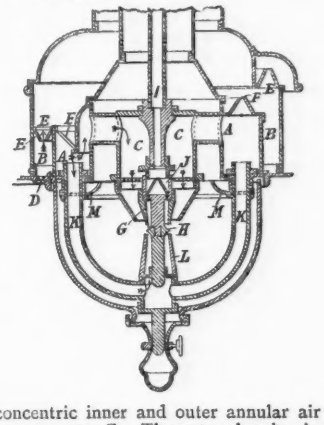
Igniting and Starting Gear for Gas-Engines.—Lanchester, F. W., of Bedford Row, Holborn, London. No. 19,846; Dec. 5, 1890. [8d.]

This invention relates to igniting-starting gear for gas-engines utilizing that type of gear in which the ignition is accomplished by the passing back of a flame when the speed of efflux of the inflammable mixture is reduced sufficiently, as described in patent No. 5479 of 1890. The present invention is intended to apply this type of igniter in starting gas-engines at a greater or less degree of compression; and the various devices described are designed to allow the communication of a flame to the explosion space from an external flame against compression.

In one mode of carrying the invention into effect, the starter nozzle connects to the compression space or cylinder by a tube, which opens to a small chamber. An annular or other passage also connects to the compression space, and communicates with the lower side of an automatic valve. When the engine is to be started, the automatic valve is allowed to be thrust down by a spring or by its own weight; and an external flame plays into the open space above it. A passage permits the flame to come into contact with the gases proceeding from the nozzle; and when they become explosive, the gases ignite and burn within the small chamber at the nozzle. When the current ceases, the flame at once passes back; and the first explosion takes place. This closes the valve, and the engine-shaft revolves; the piston discharging the burned gases, and taking in a fresh charge as before. The exhaust-valve, however, closes before the end of the compression stroke; and the rising pressure in the cylinder at once shuts the valve. The flame from the nozzle continues to burn in the small chamber until the pressure rises to that in the cylinder (or nearly so); and when the velocity of efflux becomes sufficiently reduced, the flame passes back, and the mixture in the cylinder explodes. The proportions of the nozzle and chamber are so arranged that the explosion occurs at or near the end of the stroke. In this manner a series of explosions are obtained under compression; giving more power than those obtained without compression. The valve opening to the nozzle in the small chamber opens when the pressure in the cylinder falls nearly to that of the atmosphere by the spring or its own weight, or by an added weight; and an ignition at every second revolution is given. A pilot-jet is adopted to re-light the main external flame as it is blown out at each explosion. The valve is supplied with a channel or gutter to cause a leakage through it to be supplied from the annular or other passage instead of from the small chamber; so that the back-firing action of the nozzle need not be interfered with in the event of the valve leaking.

Regenerative Gas-Lamps.—Thomas, T. C. J., of Finsbury Park. No. 21,300; Dec. 31, 1890. [8d.]

This invention in regenerative gas-lamps has for its object to render such lamps practically wind-proof. For this purpose the lamp is constructed with inner and outer air chambers arranged outside the ordinary regenerator, and each is provided with an annular air passage, or with an annular row of air passages of gradually increasing cross sectional area as they extend inward, and through which air flows on its way to the flame; the air inlet or inlets to the outer chamber being protected by a wind-guard. The passages are formed of sheet metal arranged to act as baffle-plates.



A and B are concentric inner and outer annular air chambers surrounding the air regenerator C. The outer chamber is furnished with air-inlet openings D, as shown at the left-hand side, formed in a plate that constitutes the bottom of this chamber, and carries a shade, reflector, or cover that protects the lamp bowl from rain, and also serves as a wind-guard to shield the inlet openings. E are two downwardly inclined annular plates, so arranged as to leave an annular space between them of gradually increasing width from bottom to top. The inlet to the inner chamber may be formed by an annular plate F carried by a cover, and inclined to the outer wall of this chamber, so as to leave an annular space between itself and this wall of gradually increasing cross sectional area from top to bottom.

A wind-proof lamp constructed as explained may, says the patentee, be advantageously provided with an inverted burner of the kind described in patent No. 3130 of 1890. The burner comprises a tube G, with perforated transverse diaphragm, carrying a stem with a deflector H. It is secured to a perforated plate, which forms the top of an air-heater, and to the lower end of the gas-supply pipe. Within the gas chamber J of the burner is arranged a hollow truncated cone, which serves to separate dust from the entering gas, and allow the gas to expand and flow uniformly through the perforated diaphragm. The lamp may also be provided with one or more air-tubes K (two are shown), for conducting air from the air chamber A to a central air-tube L that surrounds an extension of the stem. From this tube air will issue in an annular stream below the flame, the shape of which will consequently be determined by the joint action of the air upon its upper and lower sides. Holes are provided in the burner-plate and in the reflector M,

so as to admit air to the inner side of the lamp bowl. The lamp head may be of any suitable form.

Gas Motor Engines.—Williams, H., of Stockport. No. 970; Jan. 20, 1891. [8d.]

This invention relates to improvements in the structural arrangements of gas motor and other similar engines "for the more effective and economical working of the same." In gas motor engines of the compression type, as at present constructed, says the patentee, a considerable proportion of power is lost owing to the high tension of the ignited gases within the cylinder at the termination of the effective stroke of the piston; and the object of the present invention is to avoid this loss, and utilize as far as possible all the expanded gases for useful work by furthering their expansion behind the pistons to the utmost limit.

In one arrangement, the power cylinder is bored of two different diameters; and there is fitted therein a piston of two diameters to correspond. The combustion chamber of the smaller cylinder is connected by a suitable passage controlled by a valve to the inner end of the larger cylinder; and the inlet passage to the combustion chamber for the explosive fluid mixture is also controlled by a suitable valve—both valves (the admission-valve and the valve controlling the passage between the two cylinders) being opened and closed by connections from eccentrics on the crank-shaft, or in any other convenient manner. There are also suitable means for igniting the charge of explosive fluid mixture, and for exhausting the products of combustion at the proper time.

For convenience of description, the patentee supposes a charge of combustible mixture has been admitted and compressed within the smaller or initial power cylinder (No. 1); and that the charge in the larger or supplementary cylinder (No. 2) is also in a similar state of tension, either through the presence of air or the products of a previous combustion. At this stage—the pistons of both cylinders being at about the extent of their instroke—communication is made between the two cylinders; and the combustible charge within the initial cylinder is ignited. The gases are thus caused to expand simultaneously within the two cylinders, and propel their respective pistons on their outward or effective stroke up to a point when the expansion of the gases shall have ceased, and a tendency to a vacuum commenced. The first passage of communication between the two cylinders is then closed; and another passage of communication is formed between them by the uncovering of a port in the initial cylinder by its piston. Owing to the superior capacity of the supplementary cylinder, the products of combustion from the initial cylinder are drawn into it through the last-named passage of communication, so as to create a partial vacuum in the initial cylinder, which is filled by a new charge of combustible mixture during the remaining part of the outstroke of the pistons.

On the commencement of the instroke of the pistons, the admission-valve for the combustible mixtures is closed, and an exhaust-valve communicating with the supplementary cylinder is opened. Its piston on the instroke is thus made to expel the products of combustion up to a point where it is desirable to compress a portion of the products to form an equilibrium of pressure between the two cylinders; and at the same time the piston of the initial cylinder is compressing the charge of combustible mixture which it contains. Then, upon completion of the instroke of both pistons, the compression is complete, and communication between the two cylinders is made; the charge within the initial cylinder being ignited, and the cycle of operations repeated as before.

As an alternative arrangement, applicable to gas motor engines having an impulse at every alternate revolution of the crank—such as in the "Otto" type—the cylinders are arranged as previously described; but the cycle of operations is altered. Assuming, for convenience of description, that the initial cylinder is charged with combustible mixture, compressed by the instroke of the piston, the supplementary cylinder will at the same stage have a charge of air or other inert gas at similar tension. As before explained, a communication is made between the two cylinders; and the combustible charge within the initial cylinder is ignited—the gases expanding simultaneously within the two cylinders, so as to propel the two pistons to the full extent of their outward stroke. The pistons then return simultaneously on their inward stroke, and expel the products of combustion contained in their respective cylinders through one common exhaust-valve. On the next outstroke of the two pistons, the exhaust-valve is closed, and a valve admitting a combustible mixture is opened to the initial cylinder; while a valve admitting either air or other inert gas is opened to the supplementary cylinder. The pistons on their next outstroke will draw into their respective cylinders—*i.e.*, the initial cylinder, a combustible charge, and the supplementary cylinder, a charge of air or inert gas. On their next instroke, the two pistons will compress the charges within their respective cylinders up to the full extent of this stroke, when the connection between the two cylinders is again made. The combustible charge in the initial cylinder is then again ignited; and the cycle of operations is repeated as already described.

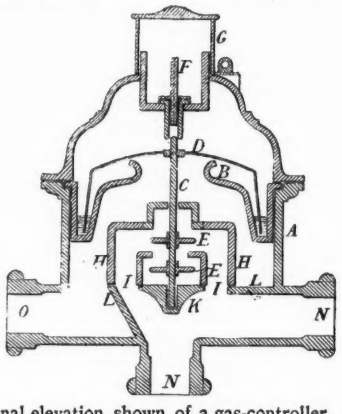
Withdrawing the Surplus Water from Reservoirs.—Thompson, C., of Baildon, Yorks. No. 1464; Jan. 27, 1891. [8d.]

This invention relates to improved appliances for withdrawing the surplus or "overflow" water from reservoirs and other water storeage works in such a manner that the water which has been longest in the reservoir (and is consequently more likely to be impure), and water in which there is more or less sediment, is first drawn off, when there is a supply greater than the demand; and the water being drawn from the bottom of the reservoir, instead of the top as heretofore, tends to keep the bottom of the reservoir clean and free from sediment.

The patentee proposes to employ outlet or overflow pipes, or a conduit built somewhat similar to an inverted ∩. One end of the pipe or conduit is bent along the bottom of the reservoir, and is open for the passage of water; while the other end is connected with the overflow-pipe. At or near the apex of the conduit, the latter is open, and formed with one of the edges overlapping the other. The action is as follows: Water passing into the inlet end of the overflow conduit will necessarily ascend the pipe or conduit to the same level as the surrounding water; and when it rises above the apex of the ∩, the water will commence flowing down the other side to the outlet; and it will so continue until the level of the water falls. The opening at the top of the conduit will prevent the ∩ acting as a syphon, and also allow more water to pass down the ∩ and to the outlet, in the event of water coming into the reservoir in greater quantity than can flow through the inlet end of the overflow conduit. The pipe supplying the main outlet is placed in the usual position.

Gas-Controllers.—Brownhill, E., of Hornsey. No. 2423; Feb. 10, 1891. [6d.]

The object of this invention of improvements in gas-controllers, which are actuated by an inverted cup sealed in mercury or other liquid, is to obtain "steadiness in the action of the float, and also a double-way for the inlet of gas to the valves, combined with greater simplicity of construction."



In the sectional elevation shown of a gas-controller, A is the outer casing or body, preferably made of cast iron; B is the trough containing mercury or other liquid; and C is the spindle, on which is fixed the float D and the equilibrium valve E. F is the spindle to carry regulating weights if required. G is a brass cap for protecting the weight spindle; and H is the valve-box, with double inlet I. K is the guide-plate, which fits into a hole bored in the platform L. M is an aperture for the guide-plate. N are inlets for uncontrolled gas from the main. O is the outlet for controlled gas.

It will be seen that the gas in its passage to the valve is not throttled; the passage being greater than the capacity of the main pipe. Thus, when the pressure of gas falls below that at which the controller is set, the flow will not in any way be impeded in its passage to the burners, &c. It will also be seen that the guide-plate K and the opening in it, being both turned to one gauge (the centre of the opening coinciding with the centre of the outer casing), will ensure the valve-box being fitted in a central position without any difficulty.

APPLICATIONS FOR LETTERS PATENT.

21,868.—Bartlett, G. H., "Ignition device for gas, petroleum, and similar engines." Dec. 14.

21,881.—Fairweather, W., "Manufacture of gas." A communication from the Acme Liquid Fuel Company. Dec. 15.

21,955.—Gielis, H., "Charging inclined retorts." Dec. 15.

21,993.—Roderick, R., "Taps or cocks for liquids, steam, air, and gas, and jointed or folding pipes for conveying liquids, steam, air, and gas." Dec. 16.

22,071.—Rock, T. D., "Gas-heated forges." Dec. 17.

22,236.—Taylor, G. H., and Lowe, W. O. A., "Gas-fired steam generator." Dec. 19.

Messrs. D. Hulett and Co., Limited, were entrusted, at short notice, with the contract to provide all the iron brackets and lamps used for lighting the streets of "Modern Venice" at Olympia. They number upwards of a hundred; and they were delivered and fixed in less than a fortnight.

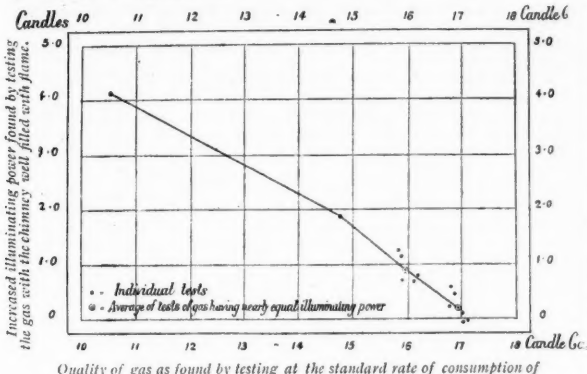
The Reading-Room at the Dover Gas-Works.—A few days ago the employees of the Dover Gas Company had an interesting gathering at the works, to celebrate the fourth anniversary of the establishment of the workmen's reading-room and library. The Company's Manager (Mr. R. Herring), who is President of the library, occupied the chair. The Secretary (Mr. Harman) briefly referred to the business of the past year, and gave a list of gifts received from the Directors, officers, and others. There are now 305 books available for home use by the men. The Chairman expressed his pleasure at the satisfactory statement made by the Secretary; and his appreciation of the kindness of the Chairman of the Company (Mr. W. Mannering), who was present, towards all the employees. After giving some timely advice to the men, he concluded by asking them for their continued assistance; trusting that the good feeling and harmony at present existing would grow stronger year by year. Mr. Mannering, in proposing a vote of thanks to the President, remarked that the movement of which they were celebrating the anniversary originated entirely with Mr. Herring, who was always desirous of promoting the interests and welfare of the men in every possible way. It was gratifying to find that his efforts had been so successful; also that the circulating library in connection with the reading-room enabled the wives and families of the men to share the privileges they enjoyed. He hoped the use of the room would be a continued source of pleasure and profit, not only to themselves but to their successors, who he trusted would continue the good work they had so successfully commenced. The proceedings closed with a musical entertainment, which was thoroughly enjoyed.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Proposed Investigation into the Standards of Light.

SIR,—I should like, with your permission, to supplement my letter of last week by the accompanying diagram, with the particulars of the experiments from which it has been constructed. It shows the improvement which results from varying the rate of consumption according to the quality of the gas, so as to obtain the proper amount of air for luminous combustion; in other words, the depreciating effect of adherence to the 5-feet rate.



Quality of gas as found by testing at the standard rate of consumption of 5 cubic feet per hour in a 6 in. by 2 in. chimney.

Gas which has been carburetted with oil may be expected to give somewhat different (although not discordant) results, since the composition of such gas would differ from that produced from coal alone.

Birmingham, Jan. 1, 1892. CHAS. HUNT.

Tests of Gas from Various Coals Carbonized at a Temperature of about 1700° Fahr.

[The Methven Screen was used as a Standard of Comparison.]

Series A.*	Average.	Series B.†	Observed Increase in Illuminating Power.	Average Increase.
Candles.	Candles.	Candles.	Candles.	Candles.
10·52	—	14·62	4·10	—
14·72	—	16·61	1·89	—
15·82	15·96	17·17	1·35	0·96
15·83		17·04	1·21	
15·84		16·58	0·74	
16·14		16·86	0·72	
16·18		16·98	0·80	
16·72	16·93	16·95	0·23	0·22
16·80		17·34	0·54	
16·88		17·39	0·51	
17·01		17·12	0·11	
17·08		17·05	0·03 (*a*)	
17·11		17·09	0·02 (*a*)	

(*a*) Decrease in illuminating power.

* In this series, the gas was tested with a No. 1 "London" standard Argand burner, with a 6 in. by 2 in. chimney, and at the standard rate of consumption of 5 cubic feet per hour.

† In this series, the same gas was tested with the same burner and chimney, but with the latter well filled with flame; the indicated illuminating power being corrected to the 5-feet rate.

The Gaslight and Coke Company's Assessment Appeals.—On the 23rd ult., an application was made to Sir Peter Edlin, at the Sessions House, Clerkenwell, on behalf of the Vestry of St. Mary Abbotts, Kensington, by Mr. Houghton, for leave to add to the evidence already given in connection with the recent assessment appeals of The Gaslight and Coke Company, which were fully reported in the last and the preceding volumes of the JOURNAL. The ground of the application was that the evidence given by Mr. Eve and Mr. Valon for the respondents was based upon an estimate as to the price of gas; and since it was given, the appellants had notified their intention of raising their charges after a certain date. Mr. Littler, Q.C., raised the preliminary objection that, as the case was closed, the application came too late. Sir Peter Edlin asked Mr. Houghton if he wished the Court to re-open the inquiry for the purpose of considering how far the act alluded to ought to influence them in determining the issues joined in the appeal. Mr. Houghton replied that he did not; and that if the application would, in his Lordship's judgment, involve the taking of any oral testimony, or discussion of any kind, he would at once concede that it would be unreasonable to ask the Court to do so. Sir P. Edlin pointed out that the Company's power to raise their price had been put before the Court; so that what was being asked for had not the merit of being something that was unavoidably absent from the inquiry. Mr. Houghton admitted that a certain increase in the price of gas was taken into consideration by the respondents' witnesses; but he said the application was conceived with a view to avoid supplemental lists. His Lordship thought it had been misconceived, and, moreover, presented impossibilities which the Court should bear in mind in a desire to depart from all the recognized rules of procedure, not only in cases of the kind before them, but in litigation generally. The application must be refused; and the Company would be allowed their costs of attendance.

MISCELLANEOUS NEWS.

THE MARKET FOR SULPHATE OF AMMONIA DURING THE PAST YEAR.

As in previous years, we have received from Messrs. Bradbury and Hirsch, of Mason's Buildings, Liverpool, a copy of their "Annual Review of the Market for Sulphate of Ammonia," for notice in our columns. It consists, as before, of some general introductory remarks, and a review of the course of the market month by month; the usual tabulated statistics being given at the end.

Messrs. Bradbury and Hirsch commence by remarking that a retrospect of the year just closed reveals those idiosyncrasies which perhaps no commodity in the field of commerce is more prone to than the one under review. When the position and surroundings are favourable, when prices are attractive—when, in fact, an article in general demand, and absolutely necessary for specific purposes, becomes intrinsically so cheap as to defeat all rivalry, and still the market is depressed, and prices are on the decline—one's judgment is apt to become obscured, because it is no longer possible to deal with the matter upon its merits. But since, in these matter-of-fact days, the office of a reviewer would rapidly become extinct unless he can in some tangible shape satisfy and convince an exacting commercial mind, it becomes a necessity to dive deeply beneath the surface to bring to light these evidently powerful influences, which have wrought such unfavourable conditions. We have been assailed before, and it will, no doubt, be the case again, for our fearlessly and undauntedly exposing illicit practices; but this cannot deter us from unreservedly stating that, after careful and impartial investigation, the present low range of value is found to be almost solely due to speculation—*i.e.*, speculation of the "bear" description.

Passing on to consider in detail the past, present, and future market, the reviewers say: First and foremost comes the question of production—*i.e.*, whether there is an over-production or not; and it is well to sift this matter thoroughly, as it already has been, and certainly will be freely used in argumentation, by those who have an interest in the maintenance of low values. Our own opinion, based upon the figures before us, is that as yet there is no over-production; and the probability of such a feature does not present itself to our minds, as regards the immediate future. An event of this kind in the far distance is not impossible, when the great developments and possibilities of the sources—to which we will especially refer later—are considered; but there is hardly any need to concern ourselves with them at present. It will be seen from our tables that, so far as the gas industry as the principal source of our ammonia supplies is concerned, the progress in the production is slow and steady—quite insufficient to affect the market seriously for years. The average increase during the past ten years has been at the rate of about 4000 tons per annum. The output from carbonizing works does not make great strides, and, with the present low value of all tar products (pitch excepted), is not likely to be much pushed. At other works where it was thought profitable to convert the coal into gas, no progress has been made, since the high price of coal and the low value of sulphate made this process barely remunerative. It is quite a different thing as far as blast-furnaces are concerned, as a general adoption of the means of collecting the gases would become an important factor in the ammonia supply. The advance is not so much marked at home as on the Continent—Germany principally—where the supply from this source certainly tends to affect the market; and we must not forget that Germany has for a long time been our best customer, having absorbed at one time one-third, and is still taking now about one-fifth of our whole production. The result of our observations is that the increase in the production is not significant at the present stage, as pointing to the danger of over-production; and when the production does assume dangerous proportions, the conditions of the market may have changed too, for the uses of ammonia appear to us to be still capable of considerable extension.

Considering next the query: "Can the question of a falling off in the consumption be raised?" the reviewers say: We think not, because the figures, as regards the shipment and the home consumption, do not sufficiently show it; and the figures to-day hardly furnish a reliable barometer. We would, in fact, prefer to consider this question more fully after the coming spring season—say, at the end of April, as we believe the present position somewhat misleading. Attention will no doubt be called to the rather large stocks; but we say that neither at home nor abroad have the usual quantities been bought, so far. As far as Germany is concerned, the small demand during the past three months has been most marked; and the cause is the almost entire cessation of autumn manuring and the petulance of the large dealers and manure manufacturers in view of a falling market. There can be little doubt that, as ammonia is not going out, a strong demand will set in shortly; and as the requirements will be for prompt or near delivery, the speculators will have not so much scope afforded to them in preventing the orders reaching the proper channel—*i.e.*, the makers. Should the demand actually show some falling off in one or two countries, others are sure to take their place—probably more than counterbalancing any deficiency. It seems almost needless to say, at the present time, that the whole world draws supplies from us; and many of the colonies are but in their infant stage of consumption with respect to the use of fertilizers. Let us, however, just for satisfaction's sake, recapitulate the countries to which shipments have been made; and it may tranquillize the mind of some nervous producer. We will take them, as far as possible, according to the magnitude of the supplies they receive: Germany, Belgium, France, Holland, Spain, Italy, West Indies, United States, Russia, Java, Mauritius, Africa, Canary Islands, Denmark, Sweden, New Zealand, Australia, and East Indies. As an instance of rapid development in many countries, we cite Java, which took nearly 4000 tons in 1891, against 200 to 300 tons in 1890. And should not the exceeding cheapness of sulphate—not merely per ton, but intrinsically per unit—furnish an argument, too, for a large increase in the consumption during the coming spring? We need but remember the enhanced consumption of nitrate last spring—a strange fact, after the

already marvellous increase in 1890, and which was principally due, we should say, to the extremely low range of prices. (Nitrate could, at one time, be bought at 7s. 6d. per cwt.) Nor is there any reason why one should not look forward to a similar occurrence as far as sulphate is concerned, if prices remain at anything like the present level. And we must assume that consumers have not gone deeply into the matter, or they would be more eager to secure cheap supplies, while the opportunity remains of buying at the bottom of the market.

Messrs. Bradbury and Hirsch next proceed to briefly compare, as follows, the unit values of the different sources of ammonia, so as to place the full facts before their clients:—

	Per Unit.
Sulphate of ammonia (24½ p. ct.)	8s. 1¼d.
Nitrate of soda (95 p. ct.)	9 6
Dried blood	9s. 6d. to 10 0
Horn meal, ground hoofs, &c	9s. 3d. to 9 6
Peruvian guano	10 0

For their further guidance, they also give the annual averages per unit during the previous ten years—*i.e.*, sulphate compared with nitrate alone. The average over the period taken is: Nitrate, 10s. 8d.; sulphate, 11s. 6d. The statement shows the present position to be quite unique. In six years out of the ten, more was paid per unit of ammonia in sulphate than in nitrate; in two, the values were about equal. In the two years of great depression, 1885-6, however, the unit in sulphate was cheaper, though not by any means to such an extent as now. But the authors point out that, although in December, 1885, the prices were almost as low as at present, they advanced to £13 in the following March, and were maintained above £12 to the end of April; while in December, 1886, the figures were below £11 as well, but they reached £12 in January, and £12 10s. in March, 1887. It would therefore pass comprehension, they say, if the full weight of the spring requirements should not fall upon sulphate, and bring about a quick change in the position. Nothing disparaging can be said against its use; and they have frequently shown in their reports that there is much in favour of it.

Referring next to the great success of nitrate of soda in the past, Messrs. Bradbury and Hirsch say it is due to its many friends, while sulphate of ammonia had but few, and those either powerless or lacking energy. But it has never been conclusively proved that nitrate holds the sceptre of superiority. It holds the sway in so far as, quantitatively, it cannot be done without; but the reviewers once more point to the fact that the production of the two commodities is out of all proportion. That of sulphate is necessarily limited; that of nitrate practically unlimited. The producing power of the combined nitrate companies per month is equal to that of Great Britain's production of sulphate per annum; and for this reason alone, to draw comparisons in respect to the movement of figures would, they urge, be illogical. Moreover, if ever one ought to be convinced that a simple rule-of-three sum, as far as these two fertilizers are concerned, is out of place, it should be through the events of last year; and the past has nearly always shown that both high prices and low ones of nitrate are misleading for the guidance of the operator in sulphate. The difference between the market prices has usually been from £2 to £3 per ton; and it is a fact worthy of note that to-day it is not even £1 per ton.

Messrs. Bradbury and Hirsch next give a few details to follow out the course they have usually taken in their arguments: At the beginning of 1891, we find sulphate at £10 12s. 6d. per ton; nitrate at 7s. 6d. to 7s. 9d. per cwt. In March, we find nitrate advanced nearly £2 per ton (to 9s. 6d. per cwt.); while sulphate had only improved 15s. (£11 7s. 6d.). In May, nitrate had lost nearly £1 of the advance (8s. 7½d.); while sulphate still remained at £11. But although nitrate maintained the same value until the end of July, sulphate had meanwhile declined to £10 12s. 6d., which was the same figure as that quoted at the beginning of the year; nitrate being £1 per ton dearer. From the end of August to the early part of December, nitrate gradually advanced until 9s. 3d. per cwt. was reached; while sulphate by slow degrees fell to £10 2s. 6d. Thus, while sulphate at the end of the year is 10s. per ton lower than at the beginning, nitrate, when comparing the two periods, shows an advance of £1 10s. to £1 15s. per ton, or a practical advantage for nitrate of about £2 per ton. We find, accordingly, that at the beginning of the year sulphate was £3 per ton dearer than nitrate, and at present, as already mentioned, is less than £1 per ton. This adds weight to the fact that sulphate is unprecedentedly cheap; and it has rarely compared so favourably with other fertilizers. To imaginings, or unwarranted predictions, that as yet the lowest point has not been touched, one cannot attach much importance, as no reasons are given for such statements; and they are generally wilful and wanton representations, emanating from selfish motives. Let us but call to mind how nitrate was talked down at this time last year; and the wiseacres would have it that it would come to 7s. per cwt. But we all know the change in the kaleidoscope before the end of February, when, instead of 7s., we had to face a price of 8s. 6d., and 9s. 6d. in March. Certainly, violent causes brought about the change in nitrate; but the unforeseen will happen, in spite of all forecasts, and a less turbulent element will suffice to bring sulphate on a different basis. The cheapness of sulphate must assert itself during the coming season; and if some advantages must be conceded to nitrate, especially during dry seasons, and for its quick and stimulating action, sulphate answers as well in most cases, if used early enough, and certainly shows better results during wet seasons. Should the, so far, open winter continue, and the season be an early one, there is certain to be a large demand for sulphate, especially as nitrate will not be superabundant in the early part of the year, as, based upon the consumption of last spring, there will only be just about enough of it. In previous years the shipments have been largely in excess of the consumption. Partly through the war, and partly through the efforts of the combination among the producers, a more equal state of things has been brought about. It is necessary to keep nitrate before our eyes, as the weight of such a large quantity of nitrogenous material must always be of influence upon the markets generally; and it should not be forgotten that the producing power of this commodity is nearly double that of the present consumption. It is easy, therefore, to recover lost ground, and make up deficiencies in this commodity—quite contrary to what would be the case if, for some reason, there should be a falling off in the ammonia supply. We think our remarks above sufficiently indicate that as yet the production and consumption of ammonia go hand in hand; and, so far as can be seen, no disturbing element will appear in the near future to seriously upset this balance. In the routine of things commercial, minor influences will always cause oscillations in a market one way or the other; and as a bright, open winter will check the supplies from the gas-works, so will frosty weather, prolonged into spring, coupled with floods and famine, hamper the consumption. However, while disposed to let the consumption take care of itself, we cannot ignore the attempts constantly made to increase the ammonia supply, though in many cases it is impossible from a pecuniary point of view; in others, it is purely chimerical. To the former belongs the carbonization of all coal, and the adoption of gaseous fuel universally; to the latter, the conversion of atmospheric nitrogen.

After referring to the interesting process suggested by MM. Bauduin and Escarpit for producing ammonia from nitrate of soda by means of a hydrocarbon such as naphthalene, and to the ammonia engine invented by Messrs. Campbell as a possible means of increasing the consumption of ammonia, passing allusion is made to the electric light, which, although regarded at one time as a possible serious factor in reducing the production of ammonia from gas-works, seems, the authors remark to affect it but little, inasmuch as its competition has not at all reduced the use of gas. In fact, the desire for more light which its introduction has stimulated, appears to have had a beneficial effect upon the gas industry. With regard to the immediate future, they consider the facts to be that producers will not sell forward prices being at such a low ebb. This, however, will not deter speculators from taking orders of those who are willing to buy. A severe battle for supremacy between these factors may therefore be expected very early in the year upon which we have just entered.

The review of the market month by month is next given, as follows:—

JANUARY.—Although the market opened somewhat dull, great activity prevailed as the month progressed. Considerable inquiries came in from France, Germany, and Spain; and we find at the close of the month an advance of fully 5s. per ton established. There was even some anxiety, when the frost broke up, to secure suitable parcels; and the speculators, especially those who had to complete engagements previously entered into, dropped all reserve, and were the foremost of the buyers. Among the Continental purchasers, many came to a halt towards the close of the month, as the enhanced values did not quite suit them. Others, however, took more hopeful views; and there was some buying for February delivery at the extreme figures. As far as the actual transactions were concerned, the following were the prices realized: £10 10s. and £10 12s. 6d. at the beginning; £10 15s. to £10 17s. 6d. during the closing week. Nitrate had nothing to do with the advance, although it might have been thought so, on account of the reports of a final arrangement among all producers to reduce the output. But sulphate was actually a trifle easier, while nitrate advanced a little during the first fortnight; and when this became weaker, sulphate took an upward turn.

FEBRUARY.—The position early in the month continued firm, although attempts were not wanting to weaken the market. A large business was doing; both dealers and consumers participating in the buying operations. Germany alone seemed to abstain—doubtless in consequence of the higher prices on this side, which were contrary to the anticipations of the consumers in that country. During the second half of the month, the market became somewhat unsettled—the dealers attempting to force prices to a lower level. But, notwithstanding this, the market fairly held its own; and quotations were little affected. The transactions during the last days were small. The quotations, which were £10 17s. 6d. at the beginning of the month, were the same at the end; but, meanwhile, £11 had been touched. It will be seen that, on the whole, the hopes of rapid improvement, to which the position in January led up, were not fulfilled; yet there was not much room for complaint. It was thought that, when the weather on the Continent moderated, a good business, especially as far as Germany was concerned, would eventuate; and makers consequently remained stiff in their ideas. Stocks were meanwhile being reduced. Nitrate was very quiet in the early part of the month, no doubt on account of the extremely heavy arrivals off coast (80,000 tons during a fortnight); but at the end of the month, it had advanced quite 10s. per ton.

MARCH.—The course of events during this month must, on the whole, have proved satisfactory to producers; and, on these grounds, the reverse of satisfactory to dealers and speculators, as well as to those consumers who had been too tardy in covering their requirements. The market, instead of falling away, as it was prophesied, soon showed symptoms of hardening; and in this firmer feeling the strong tone of nitrate certainly assisted. It advancing so rapidly—nearly £1 per ton—and reducing the difference between it and sulphate so markedly, naturally drew the attention of consumers to the comparatively cheaper commodity (sulphate); and the consequence was that they, especially those at home, vied with the speculators in picking up available spot parcels, as well as any forward contracts which could be obtained at moderate figures. Nitrate secured its advantages, as so frequently occurs in these markets, owing to unforeseen circumstances—*i.e.*, through the delayed arrival of cargoes in consequence of a spell of easterly winds; through the disturbances in Chili making future supplies a matter of some uncertainty, which in turn caused increased firmness among holders of stocks, in which they were justified also by the sharp demand that set in when consumers found they had missed favourable opportunities. Something of this kind happened in sulphate as well; and when buyers came to consider that nitrate had advanced about £1 10s. per ton since the beginning of February, while sulphate had hardly moved at all, it was not surprising that there was some anxiety to secure the necessary sulphate. If sulphate did not move up to the fullest extent warranted by the circumstances named, it was entirely due to the opposition formed by the dealers, who were considerably short of parcels wherewith to fulfil their engagements. Still, £11 10s. was touched; and the lower quotations given out towards the close of the month referred almost entirely to the dealings in second-hand parcels, in which business there was, of

course, a purpose. The figures at the beginning of the month were at £10 17s. 6d.; and by slow degrees the quotations advanced. The home demand was exceptionally good; while America was buying steadily, and France and Spain sent good orders as well. Even Germany was at last making a move, though hardly with good grace; having missed all favourable opportunities for buying.

April.—The extremely dull condition of the market during April could only be ascribed to the very backward state of the season; the persistent cold and dry weather making the farmer indifferent about spending his money (of which he has no superfluity) in manures which would have no effect upon the crops sown until moist or more genial atmospheric influences supervened. This state of things assisted speculators and dealers in being able to defer deliveries on contracts entered into, while it was also conducive to re-sales by those who had secured supplies in anticipation of an early season. A dry season, too, gave nitrate an advantage over sulphate; and it became evident that the deliveries of the former were heavier even than in the previous year. Causes like these, necessarily militating in the first instance against a brisk sale of sulphate, must eventually affect values. This, unfortunately, was the case during April, though not to any such extent as to warrant a feeling of depression. Prices certainly became easier during the early part of the month, and a similar feeling prevailed at the end; but it was noticed that, during a brief time (about the middle of the month), when speculators had to complete urgent deliveries, the market at once changed its aspect, and took a slightly upward turn. This showed both that the dealers held no stocks, and that the available sulphate was none too plentiful. During the closing week of the month, there was rather more inquiry; and as the shipments continued on a very fair scale, we argued that there need be little fear of a further reduction in the prices. It was claimed by those who had an interest in the prophecy, that they were justified in asserting that values would fall below £11 in May. It was in this month that foreign consumers first gave indications of their willingness to contract for long periods ahead. But little of this kind of business was passing, because makers would not enter into contracts; and even speculators hesitated in view of the uncertain future. As regards the prices realized during the month, they alternated, according to the requirements, from £11 5s. to £11 2s. 6d.; they being barely steady at the latter figure at the end of the month. Nitrate, too, was rather easier.

May.—The market was by no means active; but, at any rate, the prognostication of a decline to below £11 was not fulfilled. A steady business was passing—quite sufficient to maintain values. It requires no great effort at this season of the year to keep the market steady—the production being so small; for otherwise the most unseasonable weather would have had a very serious effect. The agricultural trade was a poor one; and the season altogether unsatisfactory. It could then be foreseen that, unless more life was infused into the market during the summer, an improvement in values could not take place. There were some inquiries for summer and autumn delivery; but sellers did not seem inclined to move much. Nitrate, although the small rainfall indicated its use in preference to sulphate, nevertheless shared the fate of the latter. The trade was extremely slow; and prices remained at a much lower level than was anticipated. In sulphate, quotations never exceeded £11 1s. 3d., nor were they less than £11; showing the fluctuations to have been extremely small.

June.—The depressed condition of the market during June was due to an almost unprecedented absence of demand, coupled with the unfortunate fact that the orders of the few buyers willing to operate were taken early in the month for speculative account below the then existing values. It was difficult to account for the stagnation of business; and it occurred probably in sympathy with the dullness of trade in other departments. But the Colonial business, which is usually brisk at this time of the year, was very slack; while the demand for America suddenly ceased, and the shipments to Java, hitherto on a large scale, came to an end—the season being over. The production being at this season at a low ebb, there is generally not much pressure to sell; and prices do not fluctuate much. Very often indeed the market at this season is firm, owing to small supplies. In this instance, however, the dealers, from whom all the demand emanated, held full sway over the market; and they only paid respectable prices under pressure—*i.e.*, when they were forced to complete contracts. As many makers like to clear their stores before the end of the half year, buyers scored a little by being able to secure such parcels at the lower prices; and other producers, a little scared by the aspect of the market, decided to accept the lower rates as well, rather than carry their stocks over. In this way prices came down about 7s. 6d. per ton—not a startling decline, perhaps, but still a sufficiently serious infliction at the already existing low figures. The actual figures were: £11 at the beginning, £10 17s. 6d. to £10 15s. about the middle, and £10 12s. 6d. at the close. Nitrate prices had not fallen since the beginning of May; nor were there any signs of a decline, notwithstanding the fact that the visible supply at date was, after all, equal to that of the previous year.

July.—The sluggish state of business, which was such a prominent feature of the market during June, remained unchanged during the greater part of July. It was not that there was an absence of demand, for there were buyers for every parcel offered, but that the requirements emanated from a quarter where the interest in the movement of the values lies in an opposite direction to that desired by the manufacturer. Admittedly, the buying of the dealers was not for a rise; and the shipments indicated that somehow orders had been taken by them which were but very gradually reaching the market. It was only towards the end of the month, and when the low sales of the rather plentiful supplies of the Leith market had ceased, that greater steadiness became perceptible, with a simultaneous slight hardening of prices. Taking the lowest figure accepted as £10 10s. f.o.b. Leith, there was eventually an improvement of at least 2s. 6d. per ton; and the same may be said of the Hull market, where quotations were made early in the month at £10 10s. to £10 12s. 6d.—£10 15s. being the lowest value there at the close. The Liverpool market had been irregular; and while ordinary quality was offered as low as £10 10s., high-class parcels brought 5s. to 7s. 6d. per ton more. Better values were, however, finally obtainable; and spot ordinary parcels were quoted at £10 12s. 6d. to £10 15s. again. The generally strong demand during the last days of the month seemed to augur well for prices in August; and it was an equally satisfactory feature that Continental consumers were beginning to compete for near parcels—thus weakening the influence of the dealers in their endeavours to keep prices back. The inquiry from the month of September forward was very considerable; and it was pretty clear, from the movements of the consumers, that they did not find it easy to place their orders.

August.—The market during August was not distinguished by any special features. The position was pretty much the same as it was in July, and there was again a slight advance; but the latter was too insignificant to call for any special notice or explanation. There was some eagerness, about the middle of the month, to secure the supplies of both present and future delivery. It was then that the improvement referred to took place; but the small advantage gained was partly lost again. It was, after all, not to be wondered at that the coveted better state of things was so slow in becoming apparent, when actual circumstances were taken into consideration. There was so little hopefulness in trade generally; and as regards the fertilizer department, what was there of a cheering nature, as far as the prospects of the market were concerned? The possible failure of the crops, and the consequent disastrous position of the farmer, was in itself sufficient to mar the anticipations of even the least sanguine; and those who based their ideas of higher sulphate values upon an upward movement in nitrate were, according to the events in Chili, doomed to disappointment as well. The conclusion of the Chilian war, and the resumption of regular shipments, did not provoke arguments in favour of a rise; and it could not well be prognosticated—as it was a little while before—that we should run short of nitrate in the spring. Something of the kind must have been felt by the speculative element in the sulphate market; for, eager as many of the dealers were, a few weeks previously, to pick up contracts for future delivery, as anxious did they seem to get rid of them, and, during the last days of the month, the "bear" operators were very much to the fore. Consumers appeared to be little inclined to operate; because it was impossible for them to gauge their requirements; and this, no doubt, was one of the causes of the dullish state of the market. It was, in fact, a period when it is impossible to obtain a clear view of the future. Spot values were £10 15s. at the beginning of the month; £11 to £11 2s. 6d. being paid for October-March delivery for London and Scotch makes. A firmer tone at the middle of the month caused an advance from £10 16s. 3d. to £10 17s. 6d.; the market closing at the latter figure. Nitrate was rather dearer.

September.—A glance at the course of the market during this month shows that matters did not improve; and there was a lowering tendency from no adequate cause. A superficial analysis revealed nothing beyond an apparent scarcity of orders, and perhaps an unseemly anxiety to get rid of spot parcels; but if we sift the real facts, we find that it was mostly the speculative movement in "futures" which affected the spot market. At all events, makers did not accept the lower prices till nearly the close of the month. There were sellers, principally second-hand, at the beginning of the month, at £10 15s.; great weakness, however, emanating from the Leith market, where sulphate was offering at £10 12s. 6d. A little better feeling sprang up about the middle of the month; and, with a scarcity of prompt lots, prices were firm at £10 15s. A weaker tendency, however, almost immediately supervened, much to the surprise of almost everybody, as the position remained unchanged. It was due to speculative quotations, which, at Leith, at all events, were made as low as £10 11s. 3d. to £10 10s. for spot parcels, and at £10 13s. 9d. for October-December delivery. Hull delivery at the close was offering at £10 11s. 3d. All this time nitrate was dearer, and firm at 9s. to 9s. 1¼d.

October.—There was very little change at the beginning of the month; but the sudden reduction in the Beckton quotations intensified the already-existing depression. Buyers, especially those who had sold for a fall, were quick in grasping the situation; and they endeavoured by their low offers and quotations, to influence it adversely still further. In this way, the quotations during the first half of the month were £10 10s. to £10 7s. 6d. There was a slight rally during the second half—buyers showing greater willingness to operate both for spot and future delivery; and parcels changed hands at £10 11s. 3d. to £10 12s. 6d. f.o.b. Hull, and £10 10s. f.o.b. Leith and Liverpool. The month closed barely so firmly; still there was no change in the values. The paucity of the Continental demand was remarked upon; and it was difficult to understand this, as it was admitted that sulphate was the cheapest nitrogenous material. But the disinclination of these consumers arose probably from the fact that the low quotations made by the speculators induced the belief that prices would sink still lower. Nitrate was firm at 9s. to 9s. 1¼d.

November.—It had been imagined by many that in October the lowest point had been touched; but this anticipation proved a delusion and a snare. The causes of the further relapse seemed to be twofold—first, the complete control of the market by the speculators; secondly, the absence of orders from consumers direct. The greatest source of weakness was the London market, where quotations were daily lowered to suit the requirements of the hour. A remedy for this state of things lies entirely in the hands of the producers; but one would have thought that the great cheapness of sulphate would have asserted itself without other measures. Some rather wild selling of "futures" was noticed, as if the bottom was out of the market; but it seems doubtful whether these ventures will eventually pay. The quotations were made lower as soon as the month began; there being sellers at £10 8s. 9d. Hull, £10 7s. 6d. Liverpool, and £10 5s. Leith. A little more buying took place in the middle of the month, which steadied the market for a short time; but before the end this feeling entirely disappeared, and the values did not exceed £10 5s. at Hull, and £10 3s. 9d. at Leith. Nitrate of soda maintained a firm tone throughout the month; and the prices ranged above those of October—9s. 3d. per cwt.

December.—There was very little change in the early part of the month, with the exception that buyers' ideas did not, as a rule, exceed £10 2s. 6d. It was, however, noticed that not a few of the consumers began to think well of the low prices, and considered it a fair venture to accumulate a little stock while prices were so low, in anticipation of

future requirements. In this way a good many spot parcels found willing buyers, though it was not possible to secure any tangible advance; the still low quotations of speculators destroying all chances of obtaining better prices. France participated largely in these buying operations; Germany phlegmatically abstained. The quantities offering were not so large as might have been anticipated during a month of such heavy production; and prices towards the close showed a steadier tendency—quotations generally being at £10 5s. Nitrate was more or less inactive; but prices were well maintained.

From the tables which are given at the end of the "Review," we take the following.

Production, Deliveries, and Exports of Sulphate of Ammonia during the Past Three Years.

	1889. Tons.	1890. Tons.	1891. Tons.
Production—			
England, Scotland, and Ireland from all sources	133,000	134,000	143,000
Deliveries and Exports—			
Germany, Denmark, Sweden, Russia, &c.	32,000	30,000	28,000
France, Spain and Italy	18,000	16,000	19,000
Belgium and Holland	20,000	22,000	23,000
America and Colonies	17,000	18,000	20,000
Home consumption	41,000	42,000	43,000
Stocks at works	5,000	6,000	10,000
	133,000	134,000	143,000

Comparative Weekly Prices of Sulphate of Ammonia and Nitrate of Soda during the Year 1891.

Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.
	s. d.	s. d.		s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
Jan. 3	10 7½	7 7½	April 4	11 3	9 3	July 4	10 7½	8 7½	Oct. 3	10 6	9 0
„ 10	10 7	7 9	„ 11	11 1½	9 3	„ 11	10 7½	8 6	„ 10	10 6	9 1½
„ 17	10 7½	7 10½	„ 18	11 3	9 0	„ 18	10 7	8 6	„ 17	10 7½	9 1½
„ 24	10 9	7 9	„ 25	11 1½	9 0	„ 25	10 7	8 6	„ 24	10 7½	9 1½
„ 31	10 10½	8 0	May 2	11 0	8 10½	Aug. 1	10 9	8 6	„ 31	10 7	9 1½
Feb. 7	11 0	7 10½	„ 9	11 1	8 0	„ 8	10 9	8 9	Nov. 7	10 6	9 1½
„ 14	11 0	8 0	„ 16	11 0	8 7½	„ 15	10 10	9 0	„ 14	10 5	9 3
„ 21	10 10½	8 1½	„ 23	11 0	8 7½	„ 22	10 10½	8 10½	„ 21	10 4	9 3
„ 28	10 10½	8 6	„ 30	11 0	8 7½	„ 29	10 10½	8 9	„ 28	10 3	9 3
March 7	11 0	8 6	June 6	11 0	8 7½	Sept. 5	10 9	9 0	Dec. 5	10 3	9 3
„ 14	11 4½	9 6	„ 13	10 11	8 7½	„ 12	10 9	9 1½	„ 12	10 1½	9 1½
„ 21	11 5	9 6	„ 20	10 10½	8 7½	„ 19	10 8	9 0	„ 19	10 1½	9 1½
„ 28	11 4½	9 4½	„ 27	10 8	8 7½	„ 26	10 7	9 0	„ 26	10 2	9 3

Average Prices per Ton of Good Grey (24 per cent.) Sulphate of Ammonia, f.o.b. Hull.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1882	20 17 6	21 2 6	21 6 3	20 10 0	20 4 3	20 10 6	20 15 0	20 11 3	20 9 6	20 1 3	19 6 9	19 7 6	20 8 6
1883	18 15 0	18 3 9	18 8 0	17 3 9	16 18 3	17 5 6	16 5 0	16 7 0	16 10 0	15 5 8	13 17 0	13 13 0	16 11 0
1884	14 0 6	14 5 0	14 11 6	14 10 6	14 7 6	14 13 9	14 19 0	15 8 6	15 6 3	14 12 6	13 12 0	13 3 1½	14 9 3
1885	12 12 9	12 1 3	11 18 3	11 15 4	11 3 6	11 18 3	11 14 3	11 16 6	11 2 6	10 12 6	10 8 9	10 5 9	11 9 1½
1886	10 14 6	11 5 7½	12 11 11	12 5 0	10 17 0	11 0 7½	11 3 6	11 5 7½	10 18 5	10 13 9	10 11 11	10 15 7½	11 3 7½
1887	11 12 0	11 14 6	12 3 9	11 5 3	11 13 3	12 3 9	12 12 6	12 12 0	11 17 0	11 9 0	11 9 9	11 19 6	11 17 8
1888	12 15 8	12 5 8	12 0 0	11 18 2	11 7 6	11 13 0	11 12 10	11 9 8	11 7 9	11 14 8	12 6 7	12 5 0	11 18 0½
1889	12 10 7½	12 4 8	11 19 0	11 18 9	11 19 1	11 19 6	11 16 7	12 0 9	12 2 10	11 18 2	12 1 0	12 5 4	12 1 4½
1890	12 0 11	11 16 10½	11 16 0	11 7 2	11 5 3	11 4 1	11 8 5	11 12 3	11 11 3	11 10 4	11 1 3	10 14 1	11 9 0
1891	10 13 2	10 18 9	11 5 11	11 3 9	11 0 3	10 17 6	10 13 0	10 16 3	10 14 0	10 11 3	10 7 6	10 3 9	10 15 5

Average Prices, 1869–1881.

1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881
£15 15s.	£16	£19	£21	£18 3s. 9d.	£17 2s. 6d.	£18 10s.	£18 12s. 6d.	£19 16s. 3d.	£20 5s.	£18 8s. 9d.	£19	£20 4s. 6d

MR. T. CANNING'S LECTURES ON COAL GAS.

Explosions: Their Causes and Prevention.

The second of the course of lectures which Mr. T. Canning, Engineer and Manager of the Newport (Mon.) Gas-Works, arranged to deliver before the members of the Young Men's Friendly Society in that town, was given on the 21st ult.; his subject being "Explosions: Their Causes, and How to Prevent Them."

The lecturer commenced by saying that a gas explosion is the result of applying a light to a considerable admixture of inflammable gas and oxygen, whether the latter is supplied through the medium of atmospheric air or otherwise. But there was a range of admixture. Few demonstrators had ever been successful in producing an explosion with a mixture of coal gas and air, when the former was present in less quantity than 7 per cent., except when there was another inflammable substance. This might be called the lower limit. In many experiments he had tried to go below it; but he had not yet succeeded. With an admixture of fine coal dust in agitation, he could go as low as from 1½ to 2 per cent. The range then took a rising curve; reaching its highest altitude at from 15 to 18 per cent., after which the explosions became feebler. The upper limit was when from 30 to 35 per cent. of coal gas was present. This gas, by reason of its odour and slow diffusion in air, was not specially dangerous.

The causes of gas explosions, the lecturer went on to say, are various; the two greatest being ignorance and carelessness. When a chandelier is left unsealed, and its owner distinctly smells gas, supposes there must be a leak, and then approaches with a light to seek a confirmation of his opinion—although such a man might have his opinion emphatically confirmed, he was not entitled to be called a philosopher. When gas is discovered anywhere, all lights should be removed, as much air admitted as possible, and notice sent to the gas-works. The architect who puts down in his specification a certain amount to the "jerry" builder for fittings, has much to answer for. Many architects now, however, specify the sizes and quality of pipes to be used; but they cannot ensure the capability of the gas-fitter, and therefore, as one help in this direction, the lecturer advised the registration of this class of workmen. With respect to street-mains, they were only dangerous to consumers when broken by steam-rollers, frost, or similar causes. The advice given above was all that Mr. Canning could offer in these cases also; but he said that, if any of his audience became main layers, he would recommend them, when searching for a leaky joint, to take a bucket of thick soapsuds specially made for the purpose, and dab the joint with a painter's brush. If a leak was there, it would blow out bubbles in proportion to its extent. For testing newly-filled mains or vessels, samples of the contents should be taken off in bags. The nose was the best detector of ordinary escapes; and although the odour of coal gas was not that of Arabia the Blest or of the groves of Ceylon, it was a thoroughly honest, disagreeable smell, indicating better than any contrivance the presence of gas. Coal gas could be deodorized, or even rendered fragrant; but in these cases one element of its safety would be gone. It was the safest of all lights, if properly used. Scarcely a city, town, or village in the civilized world was without it; and yet the accidents from its use were considerably fewer than those from mineral oils and electricity, in proportion to the use made of these illuminants. The lecturer illustrated the danger of electric lighting by several experiments with a current of not very high tension, and quoted from the *Electrical Review* of Dec. 20, 1889, an instance at Toledo, in Ohio, where a glazier who was measuring for a skylight on a roof accidentally touched with his wet sleeve the electric wires feeding the incandescent light, and was instantly killed and then carbonized. These wires were supposed not to be in high tension; the check of what were then called "converters" (now "transformers") having been applied to them.

Turning to the subject of explosions in coal mines, Mr. Canning remarked that these were caused by escapes of "blowers" of gas mingling with the air of the mine. Fans as now worked had not caused much diminution in the number of explosions. An especial danger attending the use of these fans was the raising of clouds of coal dust, which, mingled with small quantities of gas, formed highly explosive mixtures, and striking, in the full force of the current, the gauze of a safety-lamp, carried the flame from the interior to the exterior, thus giving rise to an explosion. What was needed to prevent such accidents was the regular and copious sprinkling of the floors of mines, and the largest possible intake of air drawn through the upcast shaft at the lowest velocity consistent with due ventilation. It still required the invention of a perfect safety-lamp, more knowledge, and more care upon the part of all who had to deal with gases, before explosions could be entirely prevented; but to a degree they were preventible. In many mines carbon disulphide, which will fire at the temperature of boiling water, is rapidly produced, and falls to the floor, being heavier than air—in fact, 4·93 cubic feet weigh 1lb. The miner looks for gas only at the roof. The late Mr. Lewis Thompson pointed out some years ago, in the JOURNAL OF GAS LIGHTING, that no gauze can prevent the ignition of carbon disulphide in a state of vapour. Ignorance of its existence and its qualities still constitutes a cause of explosions in coal mines. Absolutely non-preventible accidents rarely occur; but still they do happen. Mr. Canning gave an instance of one on Feb. 9, 1889, when two holders at the Brooklyn Gas-Works, New York, were destroyed by a tornado overturning them; the escaping gas becoming ignited at a street lamp, and causing an explosion.

The lecturer next considered the rate of combustion of explosive gaseous mixtures. He said it had been asserted by Dr. Michelson, of Berlin (following Bunsen, Mallard, and others, in their method of experiment), that, in an admixture of coal gas and air, combustion is propagated at a maximum rate of 70 centimetres (27·3 inches) per second. The experiments were made in a stout glass tube about a metre long. Mr. Canning thought the conclusion was doubtless correct as far as the tube went; but as a basis for calculating the rate of combustion, he considered it to be worse than worthless, because it was misleading, and even ridiculous. It had, however, been accepted

because a professor had gravely stated it; but let any professor tell a South Wales collier that the rate of combustion in an explosive mixture in his fiery mines was less than two miles an hour, and then let him see if that man would ever form one of his audience again. The rate of combustion, in Mr. Canning's opinion, depends, on the volume and character of the initial wave of the explosion. Explosions, according to his view, proceed in waves. In a shed in which one occurred, and which he investigated, he found three waves marked plainly by the curvature of the roof. The shed was 40 feet long, and the duration of the explosion four seconds. In the *Tankerville* petroleum ship, which exploded at Newport some months ago, the rate of progress was more rapid. An immense wave in coal workings creates intense heat, and, acting with projectile force, propagates combustion at the rate of a hurricane. In determining, therefore, the cause of an explosion, this point is well worth considering. Referring to the frequent explosions of vessels from what is called the spontaneous combustion of coal, Mr. Canning pointed out that coal does not burn spontaneously, any more than it delivers itself spontaneously into the coal-cellar. It burns with or without flame when oxidized under favourable conditions, the same as iron rusts when oxidized. The iron would burn too, only it is not carbon. When oxidation goes on in the presence of carbon, great heat is evolved. Without venturing to determine what causes the so-called spontaneous combustion of coal, he would simply say that he never found it occur except under the following conditions: (1) At the bottom of a heap of coal; (2) the coal had been stored in a wet condition; and (3) iron disulphide and sulphide of calcium were invariably present. Furthermore, he always noticed that the iron disulphide, commonly called pyrites, and sometimes "brasses," had been oxidized in the process. A diaphragm indicator with an index was used to find when gas was being evolved; but a much better plan than this was to insert wrought-iron tubes at various points in the heap of coal with a thermometer near the bottom, suspended from a plug at the top of each tube. The pipes might be perforated, and the thermometers looked at daily. In his own experience, he always found that this plan was effectual. The rising temperature showed him when to expect danger, and he took steps accordingly.

The lecture, like the former one (reported in the JOURNAL for the 22nd ult.), was illustrated by experiments, which were witnessed with marked interest.

BIRMINGHAM CORPORATION GAS SUPPLY.

An Interesting Report.

At the Meeting of the Birmingham City Council to-day, the Gas Committee will report that they have received a memorial from the day labourers and a portion of the mechanics employed at the works, asking that their hours of labour may be reduced from 54 to 53 per week; and for some other concessions as to the hours when they are entitled to payment for overtime. The Committee find on inquiry that the reduction of hours asked for by the men is becoming general in the larger manufactories in Birmingham; and having ascertained that action on their part in this direction would not affect the other Committees of the Town Council principally employing labour, they have complied with the first request, and have suggested modifications in the other proposals of the men, which have been accepted. The altered arrangements were put into operation on Dec. 10. They will affect about 450 men, and will involve an additional expenditure on the present output of about £700 per annum. With a view to economy in the stacking of coke at Saltley, the Committee have authorized the expenditure of £265 in the purchase of portable tramways and tip-trolleys. Horse-power is used in connection with these tramways; and their use will result in a considerable reduction of the number of men employed in this laborious work. The Committee regret to report that the experiment made at the Swan Village works with Elliott's stoking machinery has not proved successful. They also state that they have received notice of a re-assessment of the gas-mains in the parish of Harborne; and, being advised that this assessment is excessive, they have given notice of their intention to appeal to Quarter Sessions against it. On the application of the Improvement Committee, the Gas Committee have agreed to provide gas-fittings for the additional artizans' dwellings now being erected by the Council, and to supply the houses with prepayment meters. The result of the experiment already made with these meters has, apart from the difficulties naturally arising on the introduction of a new system, been fairly satisfactory. Improvements have been made in the construction of the meter in use, which, it is believed, will overcome some of the difficulties to be met with, and which will also enable the Committee to dispense with the frequent supervision of the meters that has hitherto been required, and has added considerably to the cost of the experiment. The Committee find that in the artizans' dwellings where these meters have already been fixed, nearly all the tenants have become consumers; and that where they have been provided in terraces of houses to which gas was previously supplied, the number of consumers has increased, although the average consumption per house has diminished. The experience which has been obtained with the use of these meters in houses at a lower rental than those already referred to, has not been encouraging; and it seems to show that it is premature at present to attempt to carry a supply for domestic lighting into courts. The Committee are of opinion that, where the collection of the pence placed in the meter can be made by the landlords, or their agents, so as to avoid the cost of frequent collection by the officers of the department, the system may be made to pay its way; and they are, therefore, willing to make a trial of it on a larger scale. With this object, they have agreed to fix prepayment meters in houses let at a weekly rent in which the landlord provides fittings, and will undertake the collection of the amounts paid for the gas supply, and the supervision of the meters. The Committee report that, while the local demand for coke was well maintained during the past summer, there was a considerable falling off during that period in the quantity sold to the iron and cement trades, on which the Committee have had to rely in former years for the disposal of a large portion of the production. As these circumstances have also affected surrounding towns, they found that the small quantity of coke which is generally imported for sale in Birmingham was increasing; and to meet this competition, they reduced the retail prices 2s. per ton from Oct. 1 last. Since that date, while the retail sales and the sales for ironmaking have been well maintained, there has been no improvement in the other markets in which the Committee have hitherto found a ready sale for this residual; and, owing to the unusual accumulation of stocks in the past summer, the stocks at the Saltley and Windsor Street works are now larger than they have been for several years. The Committee have no reason, however, to suppose that they will not be able to dispose of this accumulation in the coming summer months; the demand for coke being on the increase, and greater now than it has been for some months past. The statistics for the half year ended Sept. 30, 1891, as compared with the corresponding period of the previous year, show that the sale of gas was 1,367,060,800 cubic feet—an increase of 10½ per cent. The new services laid on were 1358, as against 910.

COVENTRY CORPORATION GAS SUPPLY.

The Alleged Nuisance from the Gas-Works—The Proposed New Works.

At the last Meeting of the Coventry City Council—the MAYOR (Mr. Singer) presiding—the report of the Gas Committee dealing with the above subjects was brought forward for approval. A summary of the document was given in the JOURNAL for the 22nd ult. (p. 1148).

Mr. ANDREWS, in moving the adoption of the report, said it would be remembered that two questions were referred by the Council to the Gas Committee—one was the memorial from persons residing in the neighbourhood of the gas-works; and the other was the general future of the gas undertaking, reckoning upon an annual increase in consumption of 6 per cent. for the next ten years. The memorial was somewhat vague; and it was rather difficult to make out in some respects precisely what the memorialists asked for, because they referred to the question of the gas being produced and stored at the present works, and afterwards they appeared to confine themselves to a demand that the whole of the manufacturing portion only should be removed to some place outside the city. The report stated very clearly that to remove the manufacturing part only, and place it outside the city, would cost £100,000; and therefore the Gas Committee could not recommend the step to be taken. He might point out that, if it was thought desirable to expend the £100,000, and remove the manufacturing plant, the city in the meantime could not do without gas; and consequently the greater portion of the money would have to be expended before the present works were touched. He might further remark that they could not erect new works without the sanction of Parliament; and he was quite certain Parliament would never sanction the citizens of Coventry borrowing and expending £100,000 merely to relieve occupiers in the neighbourhood of the gas-works of some little annoyance, and at the same time keep the manufacturing capacity of the works at its present pitch. With regard to the other question—the general future of the gas undertaking—that was still under the serious consideration of the Gas Committee, and would be reported upon again at a later date. He might point out as to this question that it confined itself to either enlarging the present works or constructing auxiliary works outside the city. Auxiliary works to produce a million cubic feet a day—that was the smallest quantity that the new works would be constructed for—would cost £50,000, or thereabouts. In any case, if additional works were erected, they would not affect the existing ones at all, because it would be necessary, to cope with future increase, that the auxiliary works should be used together with the present.

Mr. CALCOTT seconded the motion.

Mr. WEST pointed out that, when the old Gas Company were proprietors of the works, directly there was the least smoke, somebody would complain in the Council; and the Town Clerk was instructed to write to the Gas Company, threatening them with all the pains and penalties of the law. This seemed to have had the desired effect. Personally he could not believe but that the Gas Committee were quite as capable of conducting their business without causing annoyance to the residents near the gas-works as the Gas Company; and this being the case, he certainly should like to see them take the matter into consideration, and do the best they possibly could for their neighbours. At the present time the Committee were spending about £12,000 in erecting a new retort-house; and from this, he presumed they would get an increased amount of smoke and smell. He was glad to hear the Committee were contemplating the erection of auxiliary works, which he believed would result in a saving.

Mr. LEE thought the erection of new gas-works should not be entertained at the present time; but that an effort should be made to reduce the nuisance of which the memorialists complained.

Mr. WORMELL asked whether Mr. Andrews could tell them what the estimated capacity of the works would be when the new retort-house was finished. From what he could see, the Committee were preparing for an enormous increase of gas at the old works, and yet they were considering the question of auxiliary works equal in capacity to the production of a million cubic feet of gas per day.

Mr. ANDREWS, in reply, said Mr. West had stated that the Gas Committee were spending £12,000 on a new retort-house; but if he had mentioned half that sum, it would have been nearer the mark. As to the complaint regarding smells, it must be remembered that large gas-works could not be carried on without some odour. There had always been complaints; so that the subject was not new. When the new retort-house was finished, he did not think there would be any occasion for fearing that the smell would be doubled. The number of retorts to be constructed was only the same as they were going to pull down, or rather six less. With regard to the question that Mr. Wormell had put, he could not answer it straight off without referring. His impression was that the present manufacturing capacity of the works was 2½ million cubic feet per day. This quantity was not used every day, nor was it likely to be. The capacity had to be sufficient not only for the largest day's consumption, but also to allow of a reserve in case of breakdown in any portion of the works.

The report was unanimously adopted.

GAS SUPPLY IN FOGGY WEATHER.

The short spell of fog and frost with which the Metropolis and a large portion of the country were lately visited necessarily taxed to the utmost the resources of those who were responsible for keeping up the supply of gas. The extent to which the pressure was felt in the principal centres of commerce, will be gathered from the figures contained in the following paragraphs:—

Dealing first with the Metropolis, the largely increased genera demand for gas may be deduced from the extra consumption which took place in the most important district served by the Metropolitan Gas Companies—that of The Gaslight and Coke Company. It is perfectly well known that the one day of the year looked forward to with the greatest anxiety by gas managers is the 24th of December; and that this was successfully passed without any failure, is something for which credit may fairly be taken. It was truly a memorable day in the Company's history; the unprecedented amount of 128 million cubic feet of gas having been sent out from the various stations. This is an enormous quantity; and something like 13,000 tons of coal were consumed on that day to help to produce it. To meet the strain, the reserves of both gas and coal—especially the latter—had to be largely drawn upon; for, owing to the fog, it was impossible to bring up to the wharves at Beckton, and discharge, the Company's colliers, laden with raw material, lying idle in the middle of the river. By way of contrast to the output of gas on the 24th ult., we give the figures for the 30th, which was a dark, but not foggy day. The quantity delivered was 80 million cubic feet—a drop of 48 millions. According to what transpired at an interview which took place last Thursday between the Company's Secretary and General Manager (Mr. J. Orwell Phillips) and a representative of the *Daily News*, the Company are pretty well prepared for a foggy week; but a longer period of black weather, especially if accompanied by an interrupted coal supply, would be serious. A proposal has therefore been laid before the Board to increase the storeage plant by the erection of three additional holders, at a total estimated cost of £225,000. These holders are to be used as reserves, to meet emergencies like that through which the Company have just passed.

At the meeting of the General Purposes Committee of the Manchester City Council last Thursday week, Mr. Batty asked the Chairman of the Gas Committee what was being done by them to remedy the great defect as to the supply of gas during the previous few days. This was not a matter which occurred at intervals; but for several years, almost yearly about this time, there had been a short supply of very impure gas. The public mind was very much disturbed upon the matter, trade was paralyzed; and many tradesmen in the city who used gas-engines for the purpose of illuminating their premises with the electric light, were unable to obtain a sufficient supply of gas to work the engines. It would be a great relief to the public mind if some authoritative statement could be made by the Chairman of the Committee upon the subject. Mr. Brooks, the Chairman of the Gas Committee, in reply, said their efforts had been directed for some time previously to the particular emergency which had arisen, and of which Mr. Batty complained. He assured the Council and the public that such a state of affairs could never occur again. They had adequate preparations in an advanced state, which would undoubtedly for many years to come prevent a contingency arising such as then prevailed. [Some figures relating to the consumption in the city during the previous week were given in our last issue.]

The consumption of gas in connection with the Birmingham Gas Department during the week ended on Christmas Eve was larger than in any previous week on record by upwards of 3 million cubic feet. The total consumption for the week was 144,276,000 cubic feet. The highest previous record was for the week ended Dec. 18, 1890, when the consumption was 141,025,000 feet. There is always an extraordinary demand upon the resources of the department during the week preceding the Christmas holidays, owing chiefly to the long hours worked at the shops and factories. This fact and the foggy weather placed the officials of the Gas Department in an awkward dilemma; and there were fears on Thursday that the supply would not be equal to the demand, because of the continuance of the fog. The consumption for the day, however, was less than on the corresponding day of the previous year, the figures being: Dec. 24, 1891, 23,967,000 cubic feet; Dec. 24, 1890, 24,076,000 feet.

According to a local contemporary, the resources of the Leeds Gas-Works have never been put to such a severe test as during the late fogs. That they were not equal to it was, it says, apparent to anyone who noticed the diminished illuminating power of the gas, whether in the street or elsewhere. In certain parts of the borough, the pressure at times was so weak that resort had to be had to candles and lamps; while those who had to depend upon gas-engines for motive power were equally conscious of the deficiency. Up to Sunday, the 20th ult., when the fog commenced, the quantity of gas sent out from the whole of the works had closely approximated per day 12,000,000 cubic feet. On the 17th ult. the record was 14,500,000 feet. That is exactly the quantity which the whole of the plant will produce; and as it was not fully in operation—more than 200 retorts being in reserve—there was little opportunity for storing any considerable stock before the unusual demand arose. Fortunately the holders contained 2,000,000 cubic feet on Monday. On that day the consumption was above 14,000,000 feet, and this included the accumulation mentioned. On Tuesday 12,750,000 feet were sent out. The fog was less dense on Wednesday forenoon than it had been on the two previous days; and the issue for that day was upwards of 12,500,000 feet—all that was produced.

Failure of the Birmingham Compressed Air Power Scheme.—An order has been made for the winding up of the Birmingham Compressed Air Power Company. The undertaking was started a few years ago with good promise of success; but the initial expenses proved heavier than was anticipated, and consequently the demand by power users for connection with the Company's mains was not great. Further than this, the efficiency of the apparatus is stated to have been low; only about 30 per cent. of the power at the generating station being obtainable at the motors without heating the air at the point of delivery.

THE PROPOSED PURCHASE OF THE SUTTON COLDFIELD GAS-WORKS.

Opposition of Ratepayers.

Last Tuesday, a preliminary meeting was held at Sutton Coldfield to organize an opposition to the proposed purchase of the Sutton Coldfield Gas-Works and the mains through which the Birmingham Corporation supply a portion of the borough. Mr. F. Parkes, a member of the Town Council, presided. Letters of apology were received from several prominent ratepayers who were unable to attend, and who were all in favour of the object of the meeting. One of them—a Mr. Wills—contended that the works were obsolete, and could not be worked economically, while the mains were so bad that, of the 27 million cubic feet of gas manufactured per annum, 6 millions went into the atmosphere. He dissented from the estimate of the cost of the scheme presented to the Corporation. His own estimate was as follows: Purchase of the Sutton gas undertaking, £7000; compensation to the Birmingham Corporation, £5500; plant to produce 41,000,000 cubic feet per annum, £20,500—total, £33,000, to which he added 5 per cent. for contingencies (£1650), making £34,650. Besides this, there would be the purchase of additional land, sidings, &c., the expenditure for relaying mains, and a charge for loss by leakage. Therefore he was convinced that the cost of the scheme would be much nearer £40,000 than £30,000. Mr. Wills also pointed out that the Sutton Gas-Works had only been making a profit of £500 a year; so that the ratepayers were asked to pay £7000 for some obsolete works and the goodwill of a concern which had been making only a nominal profit. The result, he believed, would be that in a short time the Corporation would have to raise the price of gas. The Chairman remarked that the ratepayers were recommended to adopt the gas scheme on the report of engineers whom the Council had consulted. The engineers' report was perfectly honest with regard to the facts; but it went further and dealt with matters of opinion which the engineers had no right to deal with, but which ought to have been left to the ratepayers. He very much questioned the wisdom of the proposed purchase. Of all the reports adverse to any undertaking that he had read, the engineers' report on the Sutton Gas-Works was the most damaging. From beginning to end, it described the works as worn out and obsolete. If the shareholders had not the confidence to put into it sufficient capital to develop it, why should they expect the ratepayers to find the money? The works had been in existence about forty years; and the original capital was some £10,000 or £12,000. The plant was in such a bad state that 25 per cent. of the gas that passed through the works' meter was lost. The only good thing the engineers could say was that the retort-settings were of some value; but as they also stated that the retorts themselves were too small to make gas economically, the settings were of no use. The unsatisfactory nature of the supply was shown by the fact that some time ago a number of residents asked the Birmingham Corporation to carry their mains to Sutton. He had authority for stating that the Birmingham Corporation was prepared to supply the whole of the borough, and that, if they did so, they would not use the Sutton Gas-Works. He concluded by suggesting that the meeting should appoint a Committee to conduct the opposition to the scheme, and to raise funds for that purpose. Mr. Pickerill, Mr. Skelton, and Mr. Evans spoke in opposition to the scheme; and Mr. Parkes quoted against it the experience of some of the towns which had purchased their gas undertakings from the Birmingham Corporation. These places, he said, had a much larger consumption, a much more concentrated population, and better opportunities of obtaining coal than Sutton had. But Smethwick, which consumed 140 million cubic feet of gas per annum as compared with the 40 millions Sutton Coalfield would require, was obliged to charge 6d. per 1000 feet more than the consumers would have had to pay if they had remained customers of Birmingham. In Oldbury the consumption was above 60 millions; but there the price was 6d. per 1000 cubic feet more than in Birmingham, In West Bromwich and Tipton the difference was less marked; but still the price was greater than in Birmingham. He thought these facts conclusively showed that they in Sutton could not hope to make gas as cheaply as it could be supplied by Birmingham. The meeting decided to offer strong opposition to the scheme, and appointed a Committee for the purpose.

AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Wednesday, at the Offices, 88A, Leadenhall Street, E.C.—Mr. T. C. HERSEY in the chair.

The SECRETARY (Mr. W. M. Kight) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the accounts, which covered the period from the formation of the Company in July, 1890, to Sept. 30, 1891. The report stated that there had been a slight loss on the year's operations, amounting to £460. This was due to the reluctance of gas companies to order large installations of inclined retorts before a trial had been made on a small scale. The Directors, however, anticipated that next year (as these trials had been uniformly successful), there would be a large increase in the Company's business.

The CHAIRMAN, in moving the adoption of the report, said he would first direct attention to the fact that the Company was not formed till the latter half of 1890; and very little business was then done by them, because gas companies all over the country had at the time made their arrangements for the ensuing winter. After the winter passed by, the engineers of different gas-works began to make over tures to the Company; and since then they had done very wel indeed—not, as they all wished, in making money, but in sowing seed from which, they firmly believed, they would soon commence to reap. In many of the principal gas-works installations of inclined retorts had been put up; and in two or three most important works, they had been extended. Only a few days ago, a deputation from the Burnley Corporation Gas Committee visited the Brentford Gas-Works; and they

were so satisfied with what they saw there, that they had practically arranged for a further installation of 112 retorts. It was nearly a year ago that the first installation was put up at Burnley; and it was very satisfactory to find that, after the twelve months' experience, the Gas Committee had resolved to extend the system. At their Southall works, the Brentford Gas Company had had an installation of inclined retorts for three years; and now they had extended the system to their Brentford works. The installation there had been finished, and was working very satisfactorily—so satisfactorily indeed that the men were actually able to charge the retorts at the rate of 30 tons per man per hour. Although success had attended the Company's system, the Directors had not been without difficulties during the year. At the meeting of the Institution of Gas Engineers in May last, Mr. G. C. Trewby, the Chief Engineer of The Gaslight and Coke Company, stated that he had put in some inclined retorts at Beckton under a patent which he had himself taken out; and the working had been eminently satisfactory. This statement was published at the time; and the result was that many orders which were then coming in were withheld, because the gas companies did not know whether the system at Beckton was not cheaper than that shown by the drawings and estimates which had been submitted by the Automatic Company. Consequently, the Directors were compelled to take Counsel's opinion on the matter of Mr. Trewby's patent, which was entirely in their favour; and he was happy to say that the result of negotiations was that they came to terms, and the installation at Beckton was now being carried on (though the license was not yet actually signed) under agreement with the Automatic Company, and on payment of a royalty. Having mentioned that the South Metropolitan Gas Company were contemplating an extension of the two installations they had at the East Greenwich works, the Chairman went on to say that the Directors were expecting to develop a new branch of business in connection with chemical works. One of the proprietors of large chemical works in the Midlands, where some inclined retorts had been erected, told him that in 23 days they had paid, by the use of the system, the cost of the royalty, and had saved 1s. per ton on the coal they used in their operations. With regard to the sale of the foreign patents, they had been endeavouring to dispose of those for Italy, France, Belgium Germany, and the United States. Negotiations were still pending for four of these countries; and he was convinced that the German patent would soon be taken up by responsible people. Two gas engineers from the Colonies had been making inquiries about the Company's system; and one of them had determined to carry out in the future an installation on the Van Vestraut system.

Mr. WALTER KING seconded the motion, which was unanimously carried.

The retiring Director (Mr. J. H. Sheldrake) and the Auditors were re-elected; and after a few remarks from Mr. Van Vestraut (the Company's Consulting Engineer), the proceedings terminated.

YORKSHIRE WATER-GAS COMPANY, LIMITED.

The Second General Meeting of this Company was held last Tuesday, at Leeds—Mr. J. MITCHELL, C.E., presiding.

The report and accounts (of which a notice appeared in the JOURNAL for the 15th ult.) having been taken as read,

The CHAIRMAN moved their adoption; and, in doing so, remarked that, at the last meeting, the Directors reported that they had acquired the rights over water gas in Lancashire, and one of the results of this had been the laying down of plant at the Lancaster Waggon Works. He asked the shareholders to remember that their interest was in the success, and not in the downfall of water gas; and instead of depreciating it, as he saw by the accounts of various meetings some shareholders had been doing, they should remember that by the reports of Sir Henry Roscoe, by practical demonstration at the Leeds Forge, by practical demonstration in Harrogate for lighting, and at Lancaster for the purposes of welding, it had all the elements of success. If the shareholders had not confidence in water gas, how could they expect the public to take the matter up, and use it? He asked them to impress upon their friends that there was something in water gas, that it was what it was represented to be; and, although but slowly developed, it had done what was promised by the promoters so far as its application to metallurgical and lighting purposes was concerned. As to lighting, he had adopted the gas at his own residence, and should be pleased to allow any shareholder to see it. His friends who had seen the light were delighted with it, considering it better, steadier, and more agreeable than electricity. The difficulties of applying water gas to the welding of bosses, and more particularly to the "glutting" of wheels, at the Lancaster Waggon Works had been overcome; and it must soon be adopted by similar firms. In his opinion, water gas possessed all that he thought it did when the Company started; and he asked the shareholders, as sensible men, to stick to their interests in the Company. It was no use going about saying that water gas was a fraud, but rather let them work to make it a success. If they were to wind up the concern, their money would go. (A VOICE: "I think it has gone.") If they were to wind it up, he should be one of the first to reconstruct it; but he hoped they would see that it was to their best interests to hold their shares, and help to push the use of the gas forward.

Mr. BELLAMY seconded the motion.

Mr. T. BROOK, in moving as an amendment that the report and accounts be not adopted, remarked that the Chairman had referred to shareholders speaking of water gas as a fraud; and he stated that it was all the Directors had ever represented it to be. Let them look at the record of the past. In 1889 they were going to have water gas in London, and the country was to be turned upside down with the new gas. What was the result? They had an explosion at Windsor, and they had another at the Yorkshire Show at Hull, when a man was killed. Then, two men were killed at the Leeds Forge. He did not know whether they were aware of it, but there had been a lot of explosions at the Leeds Forge, and several furnaces had been burnt down. When the British Association visited Leeds, a number of gentlemen went to the Leeds Forge to see the water gas at work; and they had not been out of the place many minutes, when an explosion occurred, bulging out the sides of the engine-house and blowing the roof off. The Chairman had also spoken of water gas being applied to glass and steel smelting. He had been down to Castleford to see the water-gas appliances there; and he met one of the principals, who told him that they did not want the plant. Mr. Brook then referred to a pamphlet which had been issued by the British Water Gas Syndicate, and was about to quote from it, when the Chairman ruled him out of order; and this led to a little altercation between them.

Mr. LEACH seconded the amendment.

Mr. WORTH, the Managing-Director of the British Water Gas Syndicate, addressed the shareholders on the progress water gas was making, and declared his continued confidence in it.

Mr. SAMSON FOX said he could assure Mr. Brook that for lighting a house requiring from 100 to 200 lights, each consuming 5 feet of gas per hour, there was a great saving effected by using water gas. His own house at Harrogate had been lighted by water gas for upwards of three years; and there had never been any trouble with it. During the winter, when Harrogate was suffering from the want of coal gas, his house had been brilliantly illuminated. It was, in his opinion, the duty of the shareholders of the Yorkshire Company to endeavour to promote the use of water gas throughout that county and Lancashire; because he firmly believed that, if its advantages were only made known, it would be largely adopted. The worst thing that could happen to a few men who were trying to make a company a success, was to be constantly bothered and interfered with by a small number of shareholders, and held up to the contempt of the outside world. Of course, he was sorry that the shareholders had not received the dividends some of them expected; but he could not help it, and did not grumble, because the Company had only been in existence two years. They might rest assured that, if, as he believed was the case, they could produce a material which was cheaper and better than another used for the same purpose, it was bound to succeed in the end. That was just the position of water gas. One man could make of water gas as much as twenty men could make of coal gas; and by the addition of carburetted oils they could get an illuminating power of from 25 to 30 candles. In his opinion water gas would be largely adopted by the great gas companies of the country. The Yorkshire Company had not lost much money yet—£3000 in the first year, and less than half that amount in the second. He should like to see a better feeling among the shareholders towards those who were trying to make it a success.

The amendment was rejected, only four shareholders voting for it; and the adoption of the report was agreed to.

The retiring Director and the Auditors were re-elected; and the proceedings then terminated.

THE EDINBURGH ELECTRIC LIGHTING SCHEME.

At the Second Annual General Meeting of the Edinburgh Electric Supply Corporation, Limited, which was held in Edinburgh on the 23rd ult.—Mr. W. Berry in the chair—the Directors presented a report, in the course of which they stated that there were 206 shareholders upon the roll, representing a privately subscribed capital of £31,175; and as this placed the Company in a very strong position locally, they had not thought it advisable to take any public steps towards extending the list. On the 10th of September last, they addressed a letter to the Town Clerk (with a request that it should be laid before the Lord Provost's Committee at their next meeting), setting forth the advantages that would result to the city if an arrangement were arrived at whereby the lighting of the compulsory area comprised in the Provisional Order granted to the Council should be undertaken by the Company. The letter was considered, and remitted to the Lighting Committee for report. Other matters had, however, engaged the attention of the Council to the exclusion of this; but the lighting question would shortly have to be considered, as the Council, under their Order, were compelled to carry out within three years the work of lighting the compulsory area therein defined. In the meantime, the Directors had collected a large mass of information and statistics connected with similar undertakings, finished and in progress, within the United Kingdom and elsewhere, which would enable them to tender for the electric lighting of the city should the Council decide on delegating their powers to the Company. Up to the present, the shareholders had incurred no liability with regard to the expenses; nor would they do so, unless the desired contract was obtained from the Council, when the shares would be issued to the public, and the business at once proceeded with. The Chairman, in moving the adoption of the report, said he had to express the regret the Directors felt in being still unable to intimate any progress towards the definite fulfilment of the object for which the Company was formed; but no one was to blame for it. Without being too pressing, the Directors had not failed to urge their claims on the Town Council; and he could not doubt that these would be favourably considered when that body was in a position to come to a decision. They must, of course, recognize that their representatives in the Council might decide that, in the public interest, it would be preferable for them to undertake the work themselves. In that case, the existence of the concern would terminate, and the preliminary subscriptions of the shareholders returned in full. If the city entrusted the electric lighting of Edinburgh to the Company, they would do their best to keep in the front rank, both scientifically and practically. They were naturally anxious to have the business; but the shareholders might rest assured that, although the Directors would not be greedy for profit, they would not undertake any contract which did not, in their view, leave a good margin for interest and risk. Mr. G. Barclay seconded the motion; and it was carried unanimously.

Hoyland Nether Local Board and the Gas-Works.—Mr. T. Newbigging, of Manchester, has been appointed by the Hoyland Nether Local Board to inspect and value both commercially and structurally the Elsecar, Wentworth, and Hoyland Gas Company's property. The Directors of the Company raise no objection to this; but they have intimated to the Board that they do not wish to sell.

METROPOLIS WATER SUPPLY.

The Water Bills of the Corporation and the County Council.

The two Bills—alike in all essential particulars—relating to the Water Supply of London, which have been promoted by the Corporation of London and the London County Council, in virtue of an arrangement with which our readers are familiar, were duly deposited in the Private Bill Office on the 21st ult. Provision is made therein for the appointment of a Water Committee to consist of 48 members, 42 of whom are to be nominated by the County Council and the remainder by the Corporation. This Committee is to be a Committee of the Council, who are to be empowered to promote Bills to enable them to acquire, construct, and maintain water-works, and do any necessary acts in connection with affording a new or a supplemental supply of water in the districts now served by the eight Metropolitan Water Companies; to acquire or take on lease any existing or future water-works, or the undertaking of any Water Company or any part thereof, or any interest therein, or any water or right to take or convey water; to provide for the dissolution and winding up of any Water Company whose undertaking they shall acquire; to sell, lease, or dispose of any undertaking which may become vested in them; to make provisions for the raising of such moneys as may be required for carrying the Acts into operation, to supply the inhabitants of any county, or any local authority or corporation, within the defined area, and on such terms as Parliament shall authorize or direct, with water by meter or otherwise, for public or private purposes; and to carry on, consolidate, enlarge, or improve such undertakings as the County Council may acquire or construct, or to provide, by arrangement with the Companies, as to any equitable division of future profits. The Committee are to have power to make and enforce regulations for prescribing the strength, character, weight, and materials of fittings and appliances to be used for preventing the waste, misuse, and consumption of water; and to make any public or private inquiry as to the existing supply of water within the Metropolitan water area, and the charges made therefor, and as to the possible sources of supply, and to enter into negotiations with any public authority, water company, or person for the acquisition or taking on lease of any of their powers or undertakings, or any part thereof, and (subject to ratification by the County Council) to enter into and carry into effect contracts in respect thereto. The Council or the Committee are to have authority to inspect the works and plant, books, and accounts of any Company; and there are to be delegated to the Committee absolutely, and without reference to the Council, all the administrative and executive functions of carrying on the supply of water from any works acquired or constructed by the Council. They will not, however, have any power of purchasing or acquiring, selling, disposing of, or letting on lease such works, of constructing any new works, of enlarging any old works for obtaining water involving capital expenditure, of raising money by creation of stock or borrowing, or of fixing or altering the rates leviable for water, or the principal of charging or levying rates in respect of water supplied. The foregoing matters occupy the first six clauses of the Bills. The remaining six deal with the making of regulations by the Corporation as to the nomination of members of the Committee; the selection of offices and the appointment of officers; the preparation of an annual report, and other matters. In a schedule to the Bills are the names of the London Water Companies, to whose works and districts the operation of the measures will be confined.

CAPE TOWN DISTRICT WATER-WORKS COMPANY.

The Third Ordinary General Meeting of this Company was held at Winchester House, E.C., last Wednesday—Mr. J. S. Prince presiding. In moving the adoption of the report, the Chairman congratulated the shareholders on the satisfactory progress made by the Company. He said that, although the works were only certified as complete in February last, and the accounts were made up to June, the total gross revenue came to £3117; and the local Directors estimated that for the next financial year a considerable increase of revenue might safely be reckoned upon. Their report was dated Oct. 28 last; and advices since received showed that they had been too cautious in their estimate, as they now put down the revenue at £5000, and probably more. In a subsequent letter, the local Directors stated that they had each day numerous applications for water; and that new buildings were springing up in all directions. He was pleased to say that the present yield of the springs was quite ample for the purpose. Cape Town itself being still short of water, it was proposed to make another reservoir at great expense; but it was just possible that, to avoid this outlay, an arrangement might be made with the District Company for a supply from their springs. Their Mountain Spring was an exceedingly valuable source of water, especially during the winter season, when it supplied the whole of the requirements of the Company for a considerable period; and, being at a high level, pumping was rendered unnecessary—thus saving the expense of fuel and other charges connected with working the engine and pumps. The Engineer (Mr. A. W. Ackerman) reported that the spring had yielded more than sufficient to supply the whole of the district for the last six months, although, owing to the small storeage they possessed, two-thirds of the yield had run to waste. Turning to the question of finance, the Directors had not availed themselves of the authority given them to issue the 4000 preference shares; believing that it would be more to the interest of the shareholders to raise the necessary amount by the issue of 7 per cent. redeemable debentures. The Directors had privately placed £7500 of these, of which sum the contractor at Cape Town had taken £1000; showing the confidence he had in the concern. It was, however, still necessary to issue the balance, as there were several applications for extensions on very satisfactory terms to the Company. In conclusion, looking on the whole question of the Company's prospects, and without taking too sanguine a view of the position of the concern, he had every confidence that, with the support of the shareholders, the Directors would succeed in placing the Company in the ranks of the most prosperous undertakings of a similar nature. Mr. C. Crew seconded the motion; and it was carried unanimously. The proceedings closed with a vote of thanks to the Chairman and Directors.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

There is an axiom among artists that one sees only what he looks for. The Edinburgh and Leith Gas Commissioners, whether artists or not, seem to exercise the faculty as if they were. At Monday's meeting, they had before them the report of the Works Committee on the subject of the extra consumption of lime in the Edinburgh works during last summer, the gist of which I gave on the 22nd ult.; and they agreed to it without remark. The minutes which were before the Commissioners showed the position of affairs in fuller detail than was at my command when I last wrote; and a few sentences may be given from these documents to more fully show the situation. The Works Committee entrusted the inquiry into the subject to a Sub-Committee, who reported that they interviewed the chemist at the works, but his explanations did not in any great measure account for the excessive quantity of lime used. The Sub-Committee then requested the Engineer to submit a written report to them; and after receiving this, they came to the resolution that, while they regretted that Mr. Mitchell had been unable positively to account for the abnormal quantity of lime he had found it necessary to use, his explanations were consistent with the experience of other gas managers and should be accepted. Their recommendation was that more frequent tests should be made of the materials used. It is interesting to know that Mr. Mitchell produced back numbers of the JOURNAL to the Sub-Committee, including a report of a discussion at a meeting of the North British Association of Gas Managers, in support of his contention that it was not at all unknown in operations connected with gas-works to have such an experience as he had; and that the Sub-Committee based their resolution upon the scientific evidence contained in the publications to which they were directed. In his report, Mr. Mitchell said: "About the middle of June last the lime was observed not to be doing its work so effectively as formerly. When the purifiers became foul and were put out of action for the purpose of being cleaned, the impure lime taken therefrom had quite a different appearance from that which it usually has; and instead of being of a dark cake form, it was of a dry and powdery nature. The cause of this was difficult to arrive at, as the condensers, washers, and scrubbers were working as in previous years." The annular condensers were not in operation from May 21 until Sept. 11. In detailing his procedure in testing his apparatus, he stated that in the inlet-pipes to the liquor scrubber an excess of back-pressure to the extent of 25-10ths was discovered; that this back-pressure was found to exist in the two topmost tiers of boards; and that the three top tiers having been taken out, cleaned, and replaced, the pressure to work the scrubber was normal. The report proceeded: "As the whole of the purifier boxes were filled with a mixture of all the limes in store, and as a period ranging from three to six weeks must elapse before a rotation of one set can be completed, I could not ascertain until the expiry of that time whether it was due to the lime alone, or to the scrubbing apparatus being thrown out of action, or to both of these causes combined, that the purifiers required to be changed quicker than usual. On consideration of the whole matter, I am of opinion that, had the lime in question been of uniformly good quality, the inconvenience and extra cost occasioned would not have been so great." Mr. Mitchell appended a statement showing that for the months of July, August, and September the extra cost of lime was £128 12s. 4d., and of wages, £52 6s. 4d.—a total of £180 18s. 8d. Mr. Wells, who was a member of the Sub-Committee, dissented from their finding, and submitted an independent report, in which, after giving his view of the scientific aspect of the question, he said that in his opinion no blame could be attached to the lime, that the small quantity of gas passing through a large plant in the summer time arrived at the scrubber, into which an insufficient quantity of water was entering; that had there been sufficient water, the ammonia would have been completely eliminated, and the gas would have absorbed enough water to have kept the lime in the purifiers in a moist state; that there was not a sufficient quantity of water in the scrubber; that consequently the gas passed to the purifiers in a very dry state, when the ammonia, having a strong affinity for water, together with the dry gas, eagerly absorbed what little moisture there was in the lime; and that the lime, deprived of moisture, refused to perform the function of removing the sulphur, and hence the necessity to change the purifiers in rapid succession. There was sufficient in Mr. Wells's report to have warranted inquiry or experiment; but the Commissioners did not face an inquiry, but practically shelved the whole question, and to that course Mr. Wells assented. Therefore I conclude that they did not wish to see anything wrong. I do not blame them. It is no part of their duty to damage their own business; and they have probably discovered that now, but only after they had driven Mr. Wells to the course of making public a matter it would have been as well for them to have kept dark.

The Engineers' report for the month of November, showed that from the Edinburgh works the output was 130,435,000 cubic feet, an increase, as against November of last year, of 9,107,000 cubic feet; and that from the Leith works the output was 44,969,000 cubic feet, a decrease of 11,105,000 cubic feet—making a total decrease from both works of 1,998,000 cubic feet. Mr. Mitchell, in Edinburgh, got 10,002 cubic feet of gas from coal of an average price of 18s. 6·1d. per ton, as compared with 9808 cubic feet in November of last year from coal costing 15s. 9d. per ton; while Mr. Linton, in Leith, got 10,557 cubic feet from coal costing 19s. 10$\frac{3}{4}$d., as against 10,357 cubic feet last year from coal costing 16s. 6$\frac{1}{4}$d. The average illuminating power in Edinburgh was 26·56 candles, as compared with 25·52 candles last year; and in Leith, 29·50 candles, as against 26·75 candles last year.

An elaborate table was submitted which showed the quantity of gas manufactured, with the cost of coal, wages, and manufacturing and distribution charges upon revenue from the 1st of August, 1888, when the Commissioners took over the gas undertakings. In the three years dealt with, it was shown that in the Edinburgh works the yield of gas per ton of coal was 9825, 9728, and 9676 cubic feet respectively; the average cost of the coal per ton, 12s. 5·29d., 11s. 6·29d., and 16s. 4·16d.; the net cost per 1000 cubic feet of gas made, 11·07d., 10·11d., and 14·87d.; the manufacturing wages and charges, including purification,

per 1000 cubic feet made, 6·40d., 7·48d., and 8·07d.; repairs, maintenance, and renewals of works and plant, per 1000 cubic feet made, 1·41d., 1·09d., and ·64d.; the repairs, maintenance, and renewals of mains, service pipes, and meters, per 1000 cubic feet made, 1·54d., 2·09d., and 2·41d. The total charges for coal, manufacture, and distribution per 1000 cubic feet made, were: August 1, 1888, to May 15, 1889, 20·44d.; May 15, 1889, to May 15, 1890, 2 0·78d.; and May 15, 1890, to May 15, 1891, 26·30d. In the Leith works, the yield of gas was 9761, 10,360, and 10,032 cubic feet per ton of coal; the average price of coal, 10s. 5¾d., 11s. 9½d., and 15s. 5d.; the net cost of coal per 1000 cubic feet of gas made, 9·22d., 10·12d., and 14·03d.; manufacturing, &c., charges, per 1000 cubic feet made, 6·75d., 7·00d., and 8·16d.; repairs, &c., of works and plant, per 1000 cubic feet made, 1·22d., 1·76d., and 2·25d.; repairs of mains, &c., 1·24d., 3·24d., and 5·22d.; and the total cost, per 1000 cubic feet made, 18·43d., 22·12d., and 29·66d.

A question of considerable interest to gas companies and corporations was before the Edinburgh and Leith Gas Commissioners in a report by the Finance and Law Committee, that the Inland Revenue authorities proposed for the first time in the experience of the gas companies and the Commissioners not to allow the ordinary law and parliamentary expenses to be deducted before fixing the surplus on which income-tax was payable; and that the Committee, considering that it involved a payment of £70 or so of tax, had resolved to appeal against it. The action of the Committee was approved of. The result of this appeal will be eagerly looked for by others; as it will determine for them the course which the taxing authorities will pursue with regard to gas undertakings all over the country.

A very decided movement in favour of the acquisition of the gas-supply undertaking of the burgh has just been taken by the Town Council of Stirling, within which body there has frequently been talk with that object in view during the last ten or twelve years. At the last meeting of the Council, a motion was submitted by Councillor Dougall that the Lighting Committee report at an early date on the existing powers and limitations of the Council relative to the purchase or construction of gas-works for the burgh; also on the probable cost and producing capacity of the present gas-works, and the nature of existing agreements relative to burgh lighting and street wayleaves. In supporting his motion, Councillor Dougall said that he hoped its spirit and scope would commend the motion to the members of the Council. It was merely a preliminary inquiry that he asked for, for the purpose of endeavouring to correct the misapprehension which existed in the public mind, and also, judging from recent speeches, in the minds of some members of the Council itself, concerning their position in regard to the gas question. When they had the information which was asked for in his motion, they would be better able to judge the whole case on its merits. There were, he admitted, difficulties surrounding the question, which bound them down to very narrow limits in regard to their action; but it was well, he thought, that those limits should be known not only to the Council, but also to the community at large. He trusted that the terms of his motion, if carefully carried out, would yield them a full and particular understanding of their powers and their limitations as a Council. He thought they ought to adopt and work upon the broad general ground that all monopolies, such as gas supply, ought to be under the municipality. Therefore, he asked his colleagues to support his preliminary motion; and he did so in no spirit of antagonism to the Gas Company. When they considered the present enormous, or alleged enormous, profits, they should also remember that there must have been a day when there was a certain measure of risk connected with the Company, and a corresponding benefit to the community, who were enabled to enjoy the advantage of gas without any risk as to the capital employed. They should approach the Gas Company in no antagonistic spirit, but solely as discharging a public duty. The motion was seconded; and it lead to an interesting discussion, in which there was practically no opposition. It was put in such a fair spirit and moderate terms that its unanimous approval followed almost as a matter of course. It was eventually agreed to remit the motion to the Lighting Committee, on the understanding that if the expenses went beyond the usual amount allowed to Committees, and if they required a report from a skilled engineer, they must go back to the Council. The mover of the motion was added to the Committee. One of the local newspapers, in dealing editorially with this subject, says that the gas consumers of Stirling "have every reason to complain that, for such bad gas, they are charged such a high sum. We trust that, as a result of the remit, the Lighting Committee will be able at the next meeting to bring up a report which will pave the way to a speedy solution of the whole question. The Council must insist on better and cheaper gas, resolve to take over the present works, or if neither of these is found practicable, consider seriously whether it would not be the best plan to start an opposition company. The present state of matters cannot be allowed to continue much longer."

It has been stated, apparently on the very best authority, that the total amount of money borrowed for the Greenock Gas Trust undertaking down to March 25, 1891 (not deducting the amount repaid), is £142,154; the period over which the loans extend being seven years, at 3 to 4 per cent. The total amount repaid, redeemed, or placed in the sinking fund is £42,749.

Within the area of Greater Glasgow and the districts beyond, to which the Corporation Gas Commissioners now supply gas, there are rather more than 155,800 meters, which are measuring, more or less correctly, the amount of gas consumed. Over the past year there was an increase of considerably more than 3000 meters. That area is something like nine or ten miles in length by six miles in width. Of course, much of it is rural territory. There are six gas-works employed in producing the requisite lighting material, and in no case does the price exceed 2s. 6d. per 1000 cubic feet.

There has been a quiet business in the Glasgow pig iron market this week, which ended on Thursday.

It is reported by an eminent local firm of chemical brokers that the opening price of the year for sulphate of ammonia was £10 12. 6d. to £11 per ton for spot and forward, and that the close was £10 5s. to £10 12s. 6d. per ton as in delivery. The highest price was in March, when £11 15s. per ton was reached; and the lowest in December, about £10 per ton.

CURRENT SALES OF GAS PRODUCTS.

LONDON, *Jan.* 2.

Tar Products.—Unfortunately, the position of these shows no improvement, but rather the reverse. Buyers of benzol seem indisposed to pay more than 1s. 7d. to 1s. 7½d. for 50's, and 1s. 11d. to 2s. 1d. for 90's; but even at these prices they hold off in the expectation of a further fall. Anthracene is also weaker, at from 1s. to 1s. 1d. for "A" quality, and 8d. to 9½d. for "B." Oils also are sharing in the depression; and creosote is quoted very low—producers offering at as low as ¾d. per gallon on rails. There is no improvement in carbolic acid, the price for which is 1s. to 1s. 1d. per gallon for 60's. The value of tar is being seriously affected by these low prices, and were it not for pitch, the position would be a very serious one, approaching the minimum prices of a few years ago. Prices are: Tar, 18s. to 20s. Pitch, 33s. 6d. Toluol, 1s. 2d. Benzol, 90's, 1s. 11d. to 2s. 1d.; 50's, 1s. 7d. to 1s. 7½d. Solvent naphtha, 1s. 1d. Naphtha, 30 per cent., 11d. Creosote, ¾d. to 1d. Crude carbolic, 60's, 1s. 1d.; crystals 5d. Cresol, 8d. Anthracene, "A" quality, 1s. to 1s. 1d.; "B," 8d. to 9½d.

Sulphate of Ammonia shows very little improvement; but to-day's price is about £10 5s., less 3½ per cent. f.o.b. Hull, although £10 17s. 6d has been spoken of.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Except that the usual holiday stoppages of the pits for Christmas and the New Year (which, in most cases, have extended over more than a full week) have caused a temporary pressure for supplies in nearly all descriptions of fuel, there is no real improvement to notice in the coal trade of the Lancashire district; and the year opens without any upward movement in prices. The better qualities suitable for house-fire purposes remain, however, very firm, at fully late rates. Best Wigan Arley averages 12s. 6d. per ton; Pemberton four feet and second qualities of Arley, 10s. 6d. to 11s.; and common house fire coals, 9s. to 9s. 6d. at the pit mouth. Inland requirements for iron making, steam, and general manufacturing purposes, continue only moderate; and steam and forge coals do not average more than 8s. to 8s. 6d. per ton at the pit mouth. For shipment, however, there has been an active demand during the past week; and rather better prices have been ruling. Steam coals delivered at the ports on the Mersey readily fetch 9s. 9d. to 10s. 3d. per ton. The better qualities of engine fuel are moving off readily; and common sorts are not being pushed at the low figures recently accepted for special lots. But there is no actually quotable advance upon late rates. Burgy at the pit mouth ranges from 6s. and 6s. 6d. per ton for ordinary to 7s. for special sorts; best slack, 5s. to 5s. 6d.; good ordinary descriptions, 4s. to 4s. 6d.; and common sorts, about 3s. to 3s. 6d.

Northern Coal Trade.—There has been a very good demand for coal during the last few days; the supply having been reduced by the holidays. Best Northumbrian steam coal is steady, at about 10s. 3d. per ton, free on board; and second classes, 1s. per ton lower. Small steam is very quiet. The locomotive steam-coal contracts have been placed at from 1s. to 1s. 3d. per ton reduction on the prices that ruled for the 1891 contracts; and some of the most northern collieries would have taken slightly less had they been able to obtain larger contracts. Gas coal has been very firm; and the enormous consumption must have reduced the stocks held by some gas companies very considerably. A good demand may for some weeks be anticipated; though the heavy drain will now diminish. The price for odd cargoes of best Durham gas coals has of late been about 9s. 6d. per ton, free on board; but for contracts over next year, from merchants supplying orders for export, about 9s, per ton is the current price. Bunker coal is steady, with not a very large demand; a few more of the older type of vessels being laid up. Manufacturing coal is dull; the consumption being lessened by the prolongation of holidays at some of the chemical factories. Coke is rather firmer; best blast-furnace coke being in demand on rumours of duty being about to be levied in Spain. The price varies from 16s. to 16s. 6d. per ton, free on board. Gas coke is being sold at rather lower prices, to reduce the heavy stocks at some works. For contracts, about 10s. per ton seems the price.

West of Scotland.—The coal trade is practically at a standstill; and work at the collieries will be generally suspended until the middle of this week. Quotations are nominally unchanged. Splint coal is in good demand for gas purposes, and 9s. 6d. per ton f.o.b. is the closing price for this quality. The cannel outputs for the next few months are all sold at good prices. There are great complaints against the railway companies for the delay of traffic. Shipments of Scotch coal in the past week were less than in the previous week by fully 10,000 tons. A comparison with the same six days of last year shows an increase of over 48,000 tons; but it must be remembered that traffic was then practically at a standstill on account of the railway employees being on strike. This also accounts for the increase on the year to date having risen to 309,747 tons.

Fatal Accident at the Vauxhall Gas-Works.—An inquiry was recently held by Mr. A. W. Wyatt, Deputy-Coroner for East Surrey, into the circumstances attending the death of Henry Davis, a stoker in the service of the South Metropolitan Gas Company. Deceased was employed at the Vauxhall station; and while engaged in clearing a regenerator furnace, one of the fire-bars slipped out and fell into the ash pan, allowing the red-hot coke which it had supported to fall with it into the water. The body of steam generated scalded the deceased very badly, and he had to be conveyed to the hospital. On arriving there he stated that his hands only were burned. These were attended to, and he was allowed to go home. But he was subsequently admitted an in-patient, when an examination revealed the fact that the scalding extended over nearly the whole of his body. To these injuries he succumbed. There was no evidence to show negligence on the part of the Company. One of the foremen at the works stated that the bars were in fair working order; and it was deceased's duty to procure others if he found anything wrong with them. The jury returned a verdict of "Accidental death."

Proposed Water-Works for Marlborough.—The Marlborough Town Council have appointed a Committee to make preliminary inquiries as to the probable cost of erecting water-works for the borough, the cost of engineering, and the suitability of various sites.

The Wages of Gas Workers at Kingston-upon-Hull.—Regarding the paragraph on this subject which appeared in the JOURNAL for the 15th ult., we learn that the Directors of the Kingston-upon-Hull Gas Company have conceded the whole of the demands of the men, with the exception of those of the yardmen, to whom they decided to offer 3s. 10d. per day.

A Generous Gift.—Miss Talbot, of Margam, has presented to the Margam Local Board, a reservoir, having a capacity of 10,000 gallons, for the water supply of Llittyhiri, Penycaid, and Gwarycain. It appears that some time ago the Local Board took the matter in hand of supplying the district; and when Miss Talbot heard that delay would be caused by the necessary application to the Local Government Board for power to borrow the money, she generously came forward, and bore the whole expense, which has amounted to £1000.

The New Water-Works for Burnley.—The new water-works of the Burnley Corporation at Cant Clough are nearly completed; and water will now be impounded. The capacity of the reservoir is estimated at 264 million gallons. The works, which were started about seven years ago, were computed to cost about £70,000; but the total expenditure has been something like £200,000. The most remarkable feature of the works is a puddle trench, varying in depth from 100 feet, and said to be the deepest reservoir puddle trench in the world.

Longton (near Preston) Water Supply.—In addition to having received a condemnatory letter from the Local Government Board, the Preston Rural Sanitary Authority have had a letter from the Clerk to the County Council, containing a resolution passed by the Public Health Committee, calling the attention of the Authority to the possible danger to the public heath of the district south of the Ribble through the absence of a proper water supply. Unless steps were taken to supply the want, the Committee threatened to recommend the County Council to make a representation to the Local Government Board. In acknowledging the letter, the Sanitary Authority stated that notices had already been served upon the property-owners.

Rushden Gas Supply.—In continuation of the particulars given in the paragraph which appeared in the JOURNAL for the 15th ult. on the above subject, we have to record that after the resolution was carried in favour of purchasing the Rushden Gas Company's property by the parish, a poll was demanded, and it was taken on the 21st ult. Very little interest was shown in it; and only 285 persons voted. The result was as follows: For the purchase, 154 votes polled by 124 voters; against it, 241 votes polled by 165 voters—giving a majority of 87 votes and 41 voters against the proposal. The Rushden and Higham Ferrers Companies are now taking the necessary steps for voluntarily winding up each concern; and they are uniting to form a new Company, which will at once erect works in a central position for the supply of both places and the adjoining districts.

The Relative Cost of Gas and Electric Lighting.—The Accrington Corporation have under consideration a scheme for the construction of a central generating station; but before establishing it, they are anxious to ascertain what demand for the supply of electricity can be depended upon, and the inhabitants have been asked to state whether they purpose making use of the light on their premises, and to what extent. For their guidance, Mr. J. N. Schoolbred was requested to report as to the cost of the electric light as compared with the present price of gas in Accrington; and this he has done. He says that the price of the electrical energy to be supplied by the Corporation is limited by their Provisional Order to 8d. per unit. The illuminating value of a unit of electrical energy is equivalent to that of 100 cubic feet of gas; so that 10 units with incandescent lamps of 16-candle power each, will produce an amount of illumination about equal to 1000 cubic feet of gas. This electrical energy, if supplied at 6d. per unit, is equivalent to gas at 5s. per 1000 cubic feet. The cost of supply will, of course, vary with the demand; the greater the demand, the less the Corporation will be able to supply the light at. Beyond the cost of the light, will be the meter-rent at 10 per cent., as with gas-meters. As against the extra price over that paid for gas are to be set, adds Mr. Schoolbred, the undoubted advantages of cleanliness, brilliancy, and clearness of light, absence of heating, and purity of the atmosphere of the rooms where used, and a perfect freedom from danger of explosions.

Welsh Rivers and English Water Schemes.—Mr. Stuart Rendel, M.P., leader of the Welsh Parliamentary Party, in replying to a correspondent upon the proposed schemes for supplying Birmingham and London with water from Welsh rivers, writes: "I do not quite understand what is meant by protecting Welsh water for Welsh consumption. We do not protect Welsh coal or Welsh iron for Welsh consumption. The Severn and Wye carry the bulk of Welsh water into England. Is this unpatriotic and unjust? Welsh waters artificially supply Liverpool, but not at any expense or detriment to Wales. On the contrary, Lake Vyrnwy, made at the cost of Liverpool, is, or should be, of value to Wales. It should prevent the injurious flooding of the Vrynwy and Severn, and render their flow somewhat more uniform. The enterprise generally brought much money into Wales. What the Birmingham water scheme may be, I do not know. I am sure that there is no ground for supposing that, if it interferes with Welsh waters to Welsh disadvantage or without full compensation to Wales, it will obtain parliamentary sanction. If the cry of 'Wales for the Welsh' can be justly discredited, it will be by interpreting it as meaning such follies as 'Welsh water for Wales alone.' County Councils are quite right in claiming that Wales shall not part with its water to its own loss, or without full value received; but to start at the present juncture a Welsh national cry upon the catch-word of 'Welsh water for Welsh use' would only be to bring Welsh nationality into ridicule." Sir Hussey Vivian, M.P., writes in favour of carefully providing for the fullest enjoyment to the inhabitants of Wales of all such water as they may require for all time. Mr. A. J. Williams, M.P., insists that adequate compensation should be given not only to a few landowners, but for the benefit of the people.

The General Gas Lighting and Heating Company of Brussels.—According to the report presented by the Directors of this Company to the shareholders, at their annual general meeting on the 19th ult., the net profit realized by the undertaking in the year ending Aug. 31 last was 2,253,490 frs., as compared with 2,298,014 frs., in the preceding twelve months. Deducting the sinking fund and other charges, there was left a disposable balance of 899,532 frs. After paying the statutory dividend of 25 frs. per share, and making certain allowances to the Directors and chief officers, a final dividend of 11 frs. per share was recommended; making 36 frs. per share, or 7·2 per cent. (the same as before), and leaving 22,799 frs. to be carried forward. The Company have a share capital of 11,677,500 frs.; and a sum of 9,773,000 frs. has been raised on bonds. The reserve and sinking funds make together a total of 8,703,356 frs. The Company possess 19 works, and have an interest in two gas undertakings—one at Carcassonne, the other at Lisbon. Towards the close of the year 1890, the concession for the supply of gas to Raismes, a suburb of Valenciennes, was acquired; and the Company have lately completed an electric lighting installation at Catania. At Carcassonne the sale of gas increased; and consequently there was an augmentation of profits. In Lisbon, where the amalgamation of the two Gas Companies was determined upon in July last, the concession, in regard alike to the supply of gas and the electric light, has been prolonged under improved conditions. Notwithstanding the severity of the winter 1890-91, the floods with which many of the towns in France were visited, the frequent threats of strikes by the workmen (necessitating the accumulation of unusually large quantities of coal), and the sudden rise which took place in the price of raw material—all circumstances entailing expense and loss—the results were regarded by the Directors as very satisfactory. The financial position of the undertaking has further improved, owing to the substantial amounts which have been applied to the amortization of the capital. With regard to manufacturing operations, the quantity of gas made in the year covered by the report was 25,273,792 cubic metres, of which 21,813,713 cubic metres were sold. The sales in the preceding year were 21,412,484 cubic metres; being an increase of 401,229 cubic metres. Of the 86,605,632 kilos. of coal carbonized, 61,359,962 kilos., or 70·85 per cent. remained as coke; the other products being 4,476,665 kilos. of tar, and 88,650 hectolitres (1,950,300 gallons) of ammoniacal liquor. The report was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 15.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	15½–16½	..	6 7 3
100,000	10	,,	7½	Do. 7 p. c.	10	11–12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105–107*	+½	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12–14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6¼–6¾	..	5 11 1
40,000	5	,,	7½	Do. New	4	4¾–5	..	6 0 0
380,000	Stck.	13 Aug.	12½	Brentford Consolidated	100	210–220	..	5 11 4
125,000	,,	,,	9½	Do. New	100	157–162	..	5 14 2
220,000	20	16 Sept	11½	Brighton & Hove Original	20	40–42	..	5 9 6
888,500	Stck.	16 Sept.	5	Bristol.	100	98–103	–2	4 17 1
320,000	20	15 Oct.	11½	British.	20	42–44	..	5 2 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18–20	..	5 15 0
50,380	10	,,	8½	Do. 7 p. c.	10	13–15	..	5 13 4
328,750	10	,,	—	Buenos Ayres (New) Limited	10	5⅞–6⅞	–⅛	— —
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100–95*	+1½	6 6 4
150,000	20	13 Aug.	8	Cagliari, Limited	20	24–20	..	6 3 1
550,000	Stck.	15 Oct.	13¾	Commercial, Old Stock	100	240–250	..	5 10 0
165,000	,,	,,	10¾	Do. New do.	100	185–195	..	5 10 3
130,000	,,	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	117–122*	+½	5 13 9
800,000	Stck.	11 June	13	Continental Union, Limited	100	215–225*	..	5 15 6
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	185–195*	..	5 2 7
75,000	Stck.	16 Sept	10	Crystal Palace District	100	190–200	..	5 0 0
486,096	10	15 July	10	European, Limited	10	19–20	..	5 0 0
354,660	10	,,	10	Do. Partly paid	7½	14–15	..	5 0 0
5,470,640	Stck.	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	221–226	+2	5 15 0
100 000	,,	,,	4	Do. B, 4 p. c. max.	100	94–97	..	4 2 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	248–253	..	3 19 1
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	118–123	..	4 1 4
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	172–177	..	4 4 9
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	153–158	–2	4 8 7
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	245–250	..	4 0 0
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	145–150	..	4 0 0
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	110–114	..	3 10 2
294,850	,,	,,	4½	Do. 4½ p. c. dc.	100	118–123	..	3 13 2
908,000	,,	,,	6	Do. 6 p. c. do	100	160–165	..	3 12 9
3,800,000	Stck.	12 Nov.	12	Imperial Continental	100	219–224	+1½	5 7 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4–4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109–111	..	4 10 1
541,920	20	27 Nov.	6½	Monte Video, Limited	20	15–16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½–9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4–5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½–3½	..	—
				People's Gas of Chicago—				
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	94–99	..	6 1 3
500,000	100	1 Dec.	6	2nd Do.	100	93–98	..	6 2 5
150,000	10	15 Oct.	10	San Paulo, Limited	10	11–12	..	8 6 8
500,000	Stck.	28 Aug.	15½	South Metropolitan, A Stock	100	265–275	..	5 12 9
1,350,000	,,	,,	12	Do. B do.	100	220–225	+1	5 6 8
200,000	,,	,,	13	Do. C do.	100	225–235	..	5 10 8
700,000	,,	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	138–143*	+½	3 10 0
600,000	Stck.	16 Sept.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
				WATER COMPANIES.				
729,331	Stck.	30 Dec.	10	Chelsea, Ordinary	100	255–265*	+5	3 15 6
1,720,560	Stck.	15 Oct.	8	East London, Ordinary	100	203–208	+5	3 16 11
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136–140*	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	93–103	+1	3 17 8
708,000	Stck.	13 Aug	10½	Kent	100	265–275	+7½	3 16 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	220–230*	..	4 2 7
406,200	100	,,	7½	Do. 7½ p. c. max.	100	189–194*	..	3 17 4
260,000	Stck.	30 Sept	4	Do. 4 p. c. Deb. Stk.	100	120–123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares	100	335–345	+5	3 10 4
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk	100	125–127	..	3 3 0
902,300	Stck.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	147–153*	+1½	4 5 6
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	138–143*	–1½	4 10 11
1,155,066	Stck.	11 Dec.	10	West Middlesex.	100	245–255	+2½	3 18 5

*Ex div.

Sales of Shares.—Three £50 "A" (10 per cent.) shares in the *Rochester, &c., Gas Company* have recently changed hands for £114 10s. per share. Two £5 shares in the *Brompton, &c., Water-Works Company*, also paying a dividend of 10 per cent. per annum, have been sold for £14 15s. each; eight similar shares realizing £14 12s. 6d. apiece.

The Water Supply of Rotherham.—A long-standing lawsuit, between the Rotherham Corporation and the Rural Sanitary Authority, as to the rights of the water at Ulley has, it is stated, recently been amicably settled. The result will, it is believed, have an important bearing upon the prevention of impurities in the Corporation water supply.

Companies Wound Up in the Past Year.—Among the joint-stock undertakings voluntarily wound up during the past year, we notice the following: Andover Water-Works Company, Cadogan Electric Light Company, City of London Electric Lighting (Pioneer) Company, Coze Syndicate, Ketton Gas and Coke Company, Portugal Gas and Light Company, Retort Syndicate, South African Gas Company, Stapp's Water-Gas Patents, St. Helier's Water-Works Company, Water-Works Syndicate, Westerham Water-Works Company, Wingham Gas Company, Woodhouse and Rawson Electric Manufacturing Company, and Woodhouse and Rawson Electric Supply Company of Great Britain. The South Normanton and Blackwell Gas and Water Company was voluntarily wound up with a view to reconstruction; and the Birmingham Compressed Air Power Company, by order of the Court.

The Transfer of the Selby Gas-Works to the Local Board.—Last Friday, the undertaking of the Selby Gas Company was transferred to the Local Board, who have acquired it under a Provisional Order confirmed during last session. The Gas Company was founded as far back as 1832; but during the first ten years of its existence, the shareholders received no dividend. From 1843 to 1868 the dividends varied from 3 to 7½ per cent.; but so low was the stock held in the estimation of the public at one time that the shares were almost unsaleable. Since 1880 the Company have been more successful; and, besides paying a regular 10 per cent. dividend annually, have occasionally distributed substantial bonuses among the shareholders. So popular did the shares become as an investment that they have realized £50 under the hammer; and as much as £53 was offered privately for them during the pending negotiations with the Local Board. The Board have purchased the undertaking for £20,000; being equal to £50 per share. The manner in which the negotiations have been carried out by the Gas Committee has met with the general approval of the inhabitants. Mr. W. Staniland, C.E., the Chairman of the Company, was the only original proprietor left in the concern.

Polluting the Thames.—At the Staines Petty Sessions, last week, George and Robert Morgan and William Haimer were summoned by the Thames Conservancy for having emptied the contents of a cesspool into the Thames just above the intakes of the Metropolitan Water Companies. The case was clearly proved by a Conservancy official; and the defendants were fined 50s. each.

Water Supply of Adelaide.—Operations connected with the Happy Valley water-works scheme, which will secure an additional supply to Adelaide, are to be started without delay. It is anticipated that the work will take five years to complete. A reservoir will be constructed which will cover an area of 368 acres, and its storeage capacity will be 2500 million gallons, as compared with 850 million gallons, the aggregate capacity of the existing Beetaloo reservoir. The cost of the works is estimated at £417,057.

The Costs of the Mersey Water Tunnel Litigation.—With reference to the case of *Newell v. The Corporation of Liverpool*, arising out of the construction of the tunnel under the Mersey for the Vyrnwy water supply, the Town Clerk has reported to the Water Committee that the bill of costs of the plaintiff had been taxed. The bill originally delivered amounted to £3460 9s. 10d., and was allowed at £1087 8s. 3d. It was resolved that the City Treasurer be authorized to pay this amount forthwith to the Solicitors for the plaintiff.

The New Welsbach Light.—The following appeared in the *Financial News* on the 28th ult.: "Great things are expected of the new burners which have been acquired by the Incandescent Gas-Light Company. The Company ca ndo with a little more prosperity, for its career since it was formed in 1887 has been the reverse of brilliant. People who have had experience of the Lucigen Light Company, the Clamond Incandescent Gas-Light Company, the Lawrence Automatic Gas Company, the Lothammer Gas Manufacturing Company, and similar enterprises of great promise and small performance, may be pardoned for feeling a little sceptical about the practical value of the latest invention."

A Fatal Gas Explosion.—Last Tuesday, Mr. H. H. Jordan, the Deputy-Coroner, held an inquest at Stone, touching the death of Mrs. Frances Boulton, aged 61, who kept a confectioner's shop in the High Street. She was lighting the gas with a match on the morning of the 7th ult., when an explosion occurred which blew both doors and windows out, and burned the deceased very badly about the face, arms, and hands. It was stated that the deceased had a bad cold about twelve months since, and had since then lost the sense of smell; and therefore would not notice that there had been an escape of gas. She never recovered from the effects of her injuries, and succumbed on Christmas Day. The verdict of the jury was that she died from shock the result of burns accidentally received.

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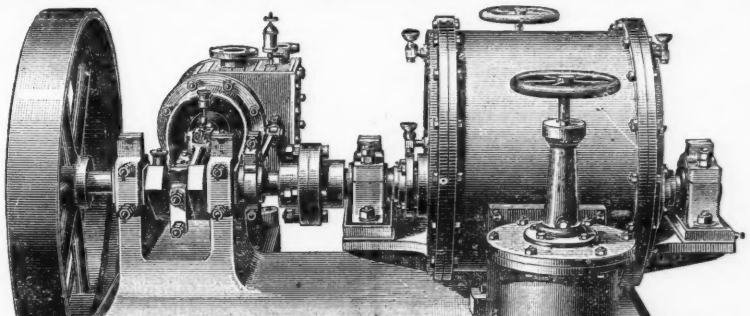

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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WANTED, by a young Man (Married), a situation as GAS-FITTER. Well up in Compo. and Iron; also in fixing Meters and Cooking-Stoves, and Main and Service laying.
Apply, by letter, to No. 2055, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

POSITION desired as Clerk in the Office of a Gas Company. Advertiser is 22 years of age. Competent to Collect, or to Inspect Meters. Good references as to character, &c.
Address No. 2054, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a young Man to assist in Stoking in a small Gas-Works. Wages £1 per week.
Apply, by letter, with references, to No. 2053, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SHEFFIELD UNITED GAS LIGHT COMPANY.

SUPERINTENDENT OF MAINS.

WANTED, by the Directors of this Company, an experienced and competent Man to SUPERINTEND their MAINS and SERVICES DEPARTMENT. He must thoroughly understand the working of Governors, and be able to advise as to the correct sizes of Pipes required to ensure an adequate supply of Gas in all parts of the Company's District.
The present area of supply is about 23 square miles.
Applications (marked "Superintendent of Mains"), stating age, married or single, previous engagements, and salary required, to be made by letter only, addressed to Sir Fredk. T. Mappin, Bart., M.P., Chairman of the Company, Gas Offices, Sheffield, not later than Friday, Jan. 8, 1892.
Testimonials not to be sent till asked for.
HANBURY THOMAS,
General Manager.
Commercial Street, Sheffield,
Dec. 18, 1891.

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HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

WANTED, a thoroughly competent Yard and Retort-House FOREMAN in a Provincial Gas-Works. Make 150 Million cubic feet per Annum. Wages two Guineas per week. Constant employment to a good and steady Man.
Apply, by letter, to No. 2052, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of RETORTS and FIRE-BRICKS.
Tenders, endorsed "Retorts and Fire-Bricks," must be delivered to me not later than Tuesday, the 19th day of January, 1892.
Specification, Quantities, and Form of Tender may be obtained upon application to the Manager, Mr. W. Whatmough.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
ALFRED WALLIS,
Town Clerk.
Municipal Buildings,
Heywood, Jan. 1, 1892.

CIRENCESTER GAS COMPANY, LIMITED.

SALE OF 300 SHARES.

THE Directors of the Cirencester Gas Company, Limited, give notice that 300 £15 NEW ORDINARY SHARES, bearing a maximum Dividend of 7 per cent., of and in the Cirencester Gas Company, Limited, being a portion of the additional Capital authorized to be raised under the provisions of the Cirencester Gas Order, 1891, will be offered FOR SALE by auction by Messrs. Moore and Hill, at the King's Head Hotel, Cirencester, on Monday, the 18th day of January, 1892, at Four o'clock in the afternoon precisely, in lots of Five each, and will be issued to each purchaser as paid-up Shares after full payment of the purchase-money.
Further particulars and Conditions of Sale may be obtained from the Auctioneers, Corn Hall Buildings, Cirencester; Messrs. Mullings, Ellett, and Co., Solicitors, Cirencester; or of
J. P. BEECHAM,
Secretary.
12, Silver Street, Cirencester,
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Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

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THE Corporation of Birkenhead are prepared to receive TENDERS for the purchase of about 350 tons of SPENT OXIDE, now lying at their Gas-Works.
Forms of Tender and Samples may be obtained from the Gas Engineer, Mr. T. O. Paterson, C.E., at the Gas-Works, Thomas Street.
Tenders, sealed and endorsed "Tender for Spent Oxide," to be sent in to me not later than Five p.m., on Friday, the 8th of January, 1892.
The Corporation do not bind themselves to accept the highest or any tender.
By order,
ALFRED GILL,
Town Clerk.
Town Hall, Birkenhead,
Dec. 23, 1891.

TO BE SOLD BY AUCTION, BY

MR. JNO. J. CUNNAH, at the Nag's Head Inn, Farndon, Cheshire, on Wednesday, the 27th day of January, 1892, at Two for Three o'clock in the afternoon, and subject to conditions which shall then be produced—
All that Freehold Property known as the HOLT AND FARNDON GAS-WORKS, situate at Dee Lane, Holt, Denbighshire, and supplying the parishes of Holt and Farndon with Gas.
The Property consists of most substantial stone-built Retort-House, Purifying-House, Meter-House, Governor-House, Lime-House, Coal-Shed, large Gasholder, and extensive Yard, the whole containing 1098¼ square yards; and about 3 miles of Gas-Mains, with necessary Branches, 51 Meters, and all Plant, Machinery, Fittings, and Appliances necessary for supplying Gas to the neighbourhood.
Also, all that compact DWELLING HOUSE, Shippon, with Loft, Pig-Stye, and large Garden adjoining the Works, and occupied by the Gas-man; the whole containing 355 square yards.
Also a WEIGHING-MACHINE and MACHINE-HOUSE, which is extensively used by the Fruit Growers in the district.
N.B.—The concern is capable of being much extended, and will be sold as a going concern as from the 1st of January, 1892, and affords a most desirable Investment for Capitalists and others.
For plans and particulars, apply to Messrs. ROYLE and REYNOLDS, Solicitors; or the AUCTIONEER, Newgate Street, CHESTER.

MR. W. H. BENNETT having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Inventions may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.
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Doing all the work of Purification between the Condensers and Purifiers, and relieving them of much work. Its cost is less than any other known Apparatus for purifying Gas from Tar and Ammonia.

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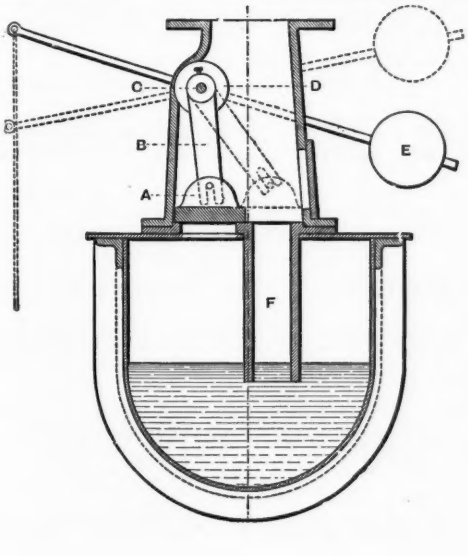

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Is perfectly reliable in action, and requires no attention.
Has all the advantages of the Dip and Anti-Dip combined.
Is cheap, and easily fixed to any form of main.
Will save more than their cost in one season's working.

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5, Norfolk Street, Manchester, Dec. 11, 1889.

SIR,—I have examined your Anti-Dip arrangement, and have seen it at work on the Retort-Benches at the Longwood Gas-Works, and the opinion which I have formed of its simplicity and certainty in working is distinctly favourable; so much so *that I consider it to be, without exception, the most efficient Appliance of the kind which has yet been introduced.* It can be applied to existing Benches with great ease, and at a minimum cost. So far as I am aware, it embodies a principle of action not previously applied in this direction.—Yours truly, THOS. NEWBIGGING.

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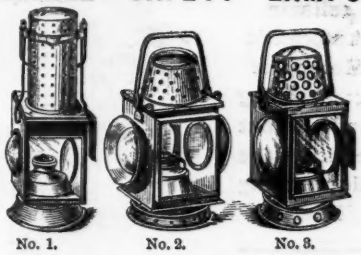

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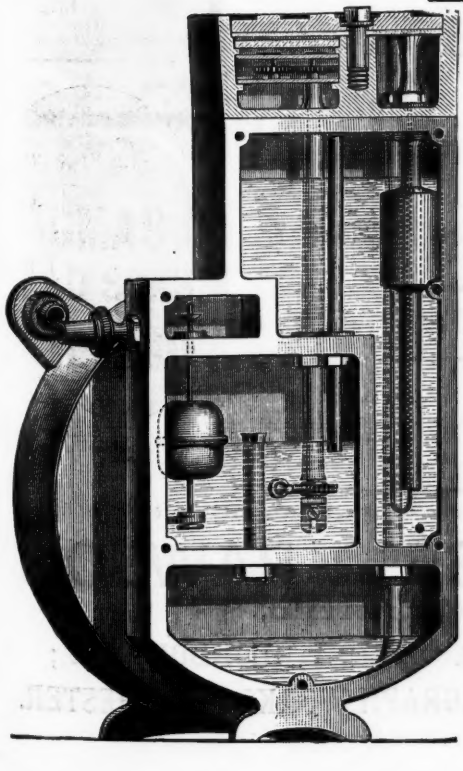

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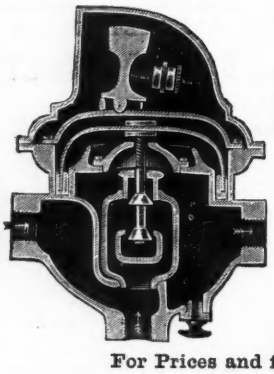

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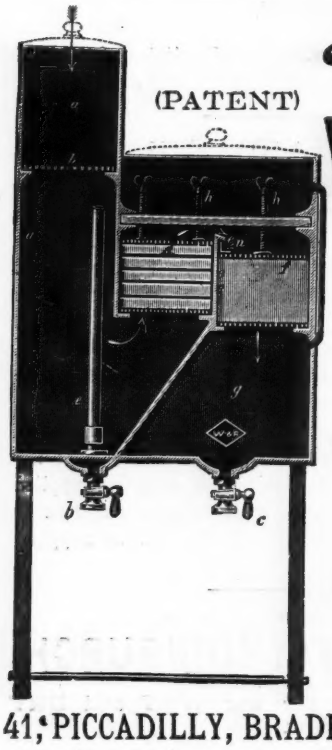

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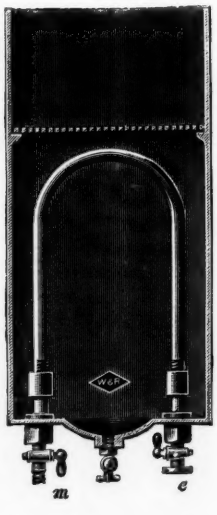

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THE AUTOMATIC SYSTEM OF CHARGING & DRAWING INCLINED GAS-RETORTS.

GOLD MEDAL, PARIS EXHIBITION, 1889.

GAS and CHEMICAL WORKS in ENGLAND where the System is in operation, or at present erecting, under the Company's Licence—

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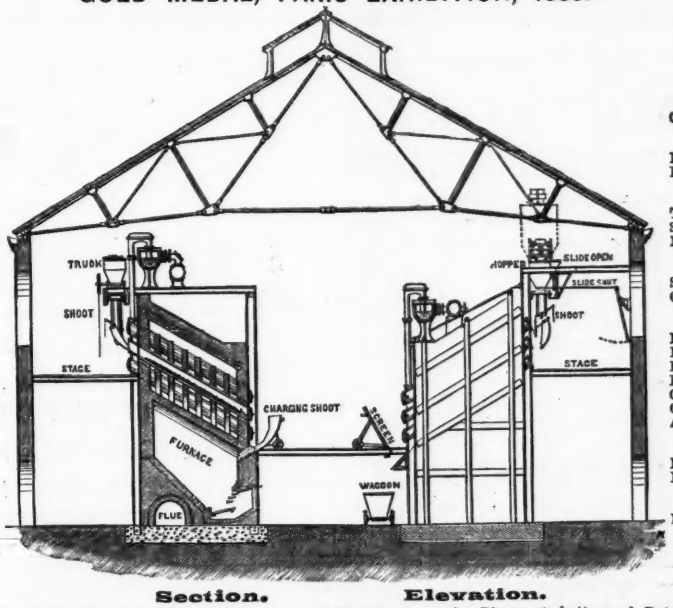

Advantages—

1. NO SKILLED LABOUR REQUIRED.
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5. ABSOLUTE CONTROL OF PRODUCTION BY UNSKILLED LABOUR (THIS IS IMPORTANT ESPECIALLY WHERE THERE IS AN EXTRA DEMAND FOR GAS, AS IN THE CASE OF MEN ON STRIKE, FOGGY DAYS, ACCIDENTS, &c.)
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Section. Showing Ascension-Pipes and Hydraulic Main at top of Retort. Charged by movable Shoot and Truck.

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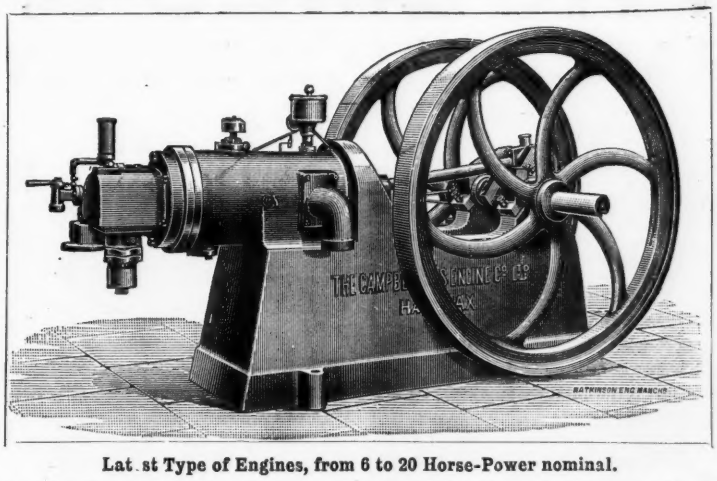
The whole worked from Stage. With or without Regenerative Settings.

These Systems are fully Patented, and any Infringer will be strictly proceeded against.

For further particulars apply to W. M. KIGHT, Secretary of THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86 and 88A, LEADENHALL STREET, LONDON, E.C.

THE "CAMPBELL" GAS-ENGINE,

MOST SIMPLE AND MOST EASILY MANAGED.



MOST ECONOMICAL IN GAS AND LEAST LIABLE TO BREAKDOWNS.

Latest Type of Engines, from 6 to 20 Horse-Power nominal.

Our Engines are used by Her Majesty's War Department; The South Metropolitan Gas Company, London, S.E., at the Bedworth Gas-Works; Crossgates Gas-Works; Tiverton Gas-Works; &c.

PRICES AND FULL PARTICULARS FROM THE SOLE MAKERS—

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SPECIALLY PREPARE GASOLINE OF ANY SPECIFIC GRAVITY BEST ADAPTED FOR CARBURETTING GAS; ALSO PETROLEUM ETHERS OF CONSTANT BOILING POINTS.

Prices and Samples may be had upon application.

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NEW HIGH-POWER GAS-LAMP.

Westphal's Patent.

Gas Companies should hire these Lamps to their Consumers, and introduce them for Street Lighting as a rival to the Electric Light, as they do not get out of order, are most economical, and the Burner being a circular slit does not choke up.

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MAKE

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OF ALL FORMS AND SHAPES IN IRON OR STEEL

BY SPECIAL HYDRAULIC MACHINERY.

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Proprietors of

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ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

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With recent improvements.

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RESULTS UNAPPROACHED BY ANY OTHER SYSTEM.

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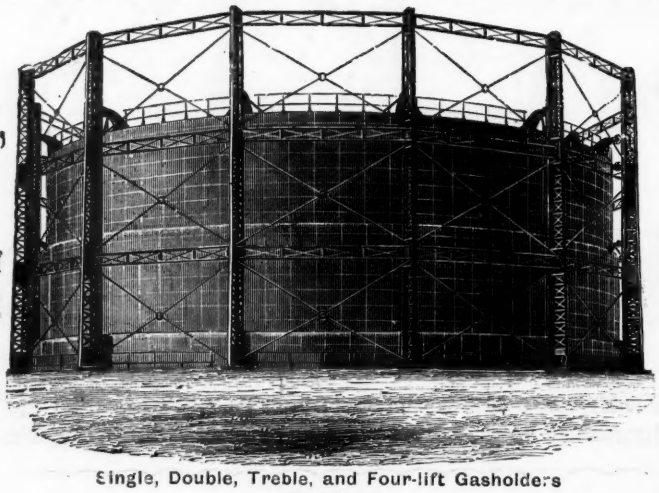

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Perfectly automatic, and cannot get out of order. Prices low. All particulars on application.

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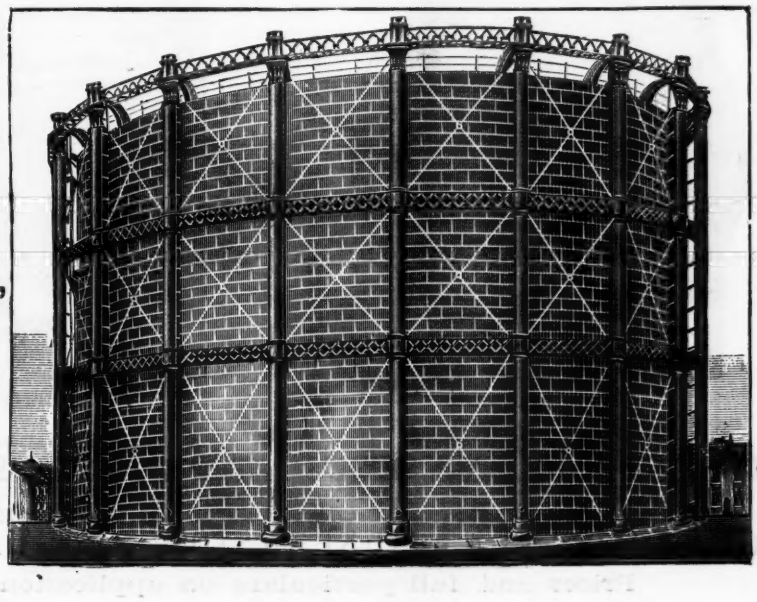

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RETORTS CAREFULLY PACKED FOR SHIPMENT.

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Sulphate of Ammonia Apparatus.

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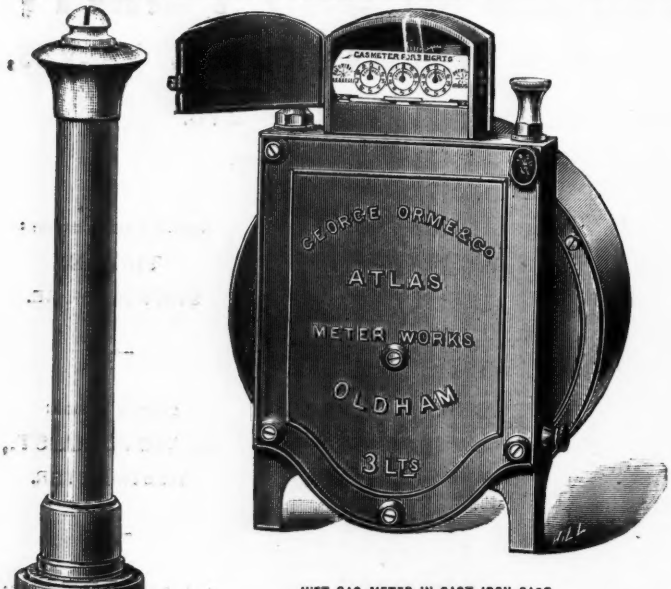

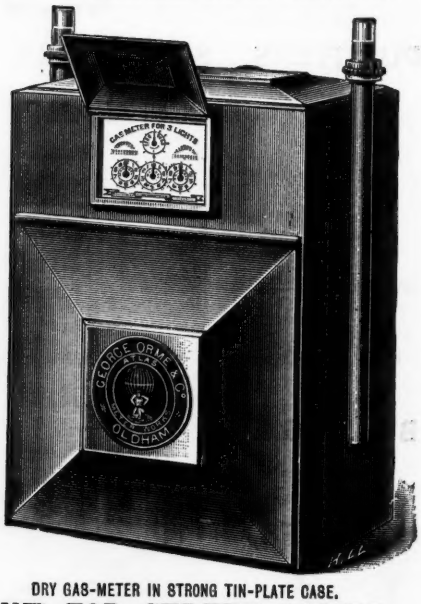

WET GAS-METER IN CAST-IRON CASE. DRY GAS-METER IN STRONG TIN-PLATE CASE.

ORME'S GAS REGULATOR (BEHL'S PATENT) FOR STREET LAMPS,

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Adopted by the leading London and Provincial Gas Companies: **More than 150,000 now in use.**

ORME'S PATENT SUSPENSION REGULATORS.

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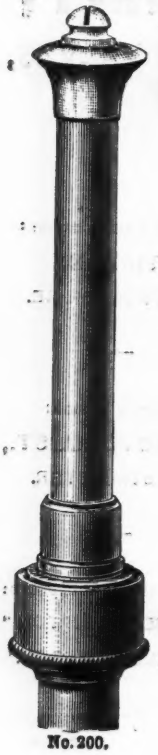

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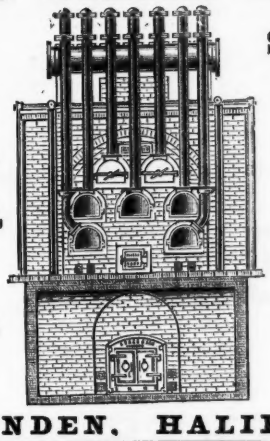

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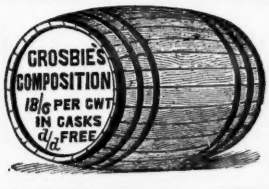

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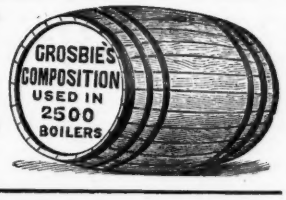
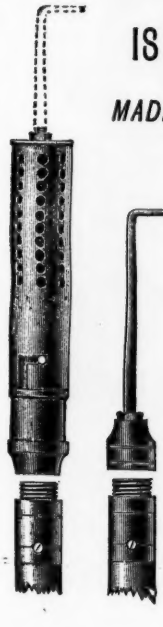
Crosbie's Paints for Gas-Works. Economical and Durable.



THE "FALCON" LAMPLIGHTER'S TORCH



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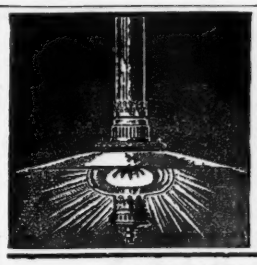

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HIGH-POWER GAS-LAMP.

The attention of Gas Engineers is particularly called to this Lamp as being the **cheapest, most simple, durable, and adaptable Lamp in the market.**

Two sizes, consuming 6 feet and 9½ feet per hour respectively.

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STEEL SCOOPS FOR RETORT CHARGING.

Scoops supplied with or without handles and of any dimensions or shape required

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HENRY BALFOUR & CO.,

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And all Classes of GAS PLANT,

REVOLVING BRUSH SCRUBBERS, FOUR-WAY VALVES.

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Incorporated with the Leeds Fire-Clay Company, Ltd.,

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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
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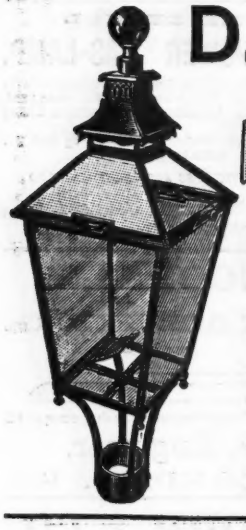

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Manufacturers of every description of Gas-Fittings.

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No putty required.
Glass secured by hinged clips. No loose parts.
A new pane of glass can be fitted in a few minutes by any inexperienced person.
Glass can be supplied cut ready for use.
The frames are not liable to be damaged as in ordinary lamps when hacking out a broken pane of glass.
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Several thousands of these are now in use, giving general satisfaction.
They are strongly made, and of best material.

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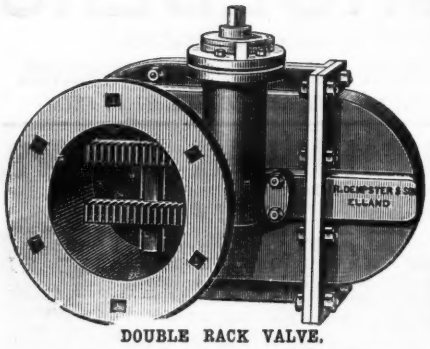
VALVES.



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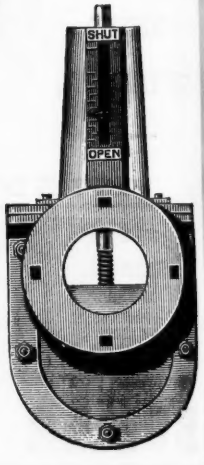

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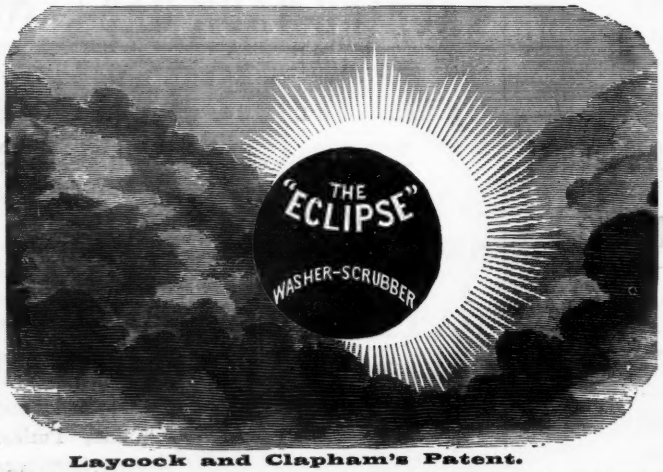


Laycock and Clapham's Patent.

The most efficient Machine known for extracting Ammonia and other Impurities from Coal Gas.

55 "Eclipse" Washer-Scrubbers, varying in capacity from **50,000** to **4,000,000** cubic feet per day, passing a total of **54,450,000** cubic feet of Gas per day, have been erected.

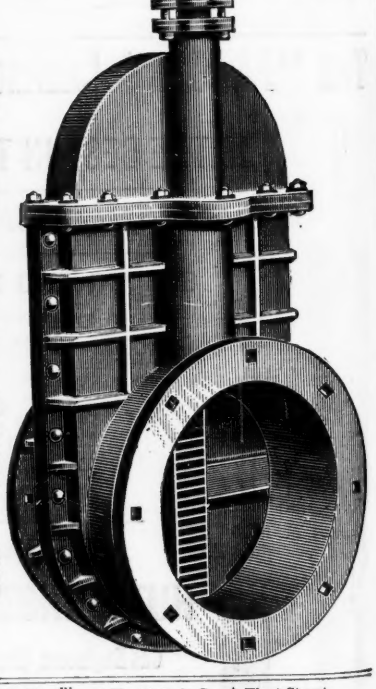
The Patent Wooden Balls thoroughly break up the Gas; give an immense amount of freshly-wetted Surface; and do not clog or increase back pressure.

While the Gas is passing through and amongst the Balls, it is continually showered upon by the contents of Buckets.

The Shaft Revolves in Improved Bearings, and all Workings are accessible.

REPAIRS AND TROUBLE REDUCED TO A MINIMUM.

Clapham's Improved Internal Rack and Worm Valve.



SILVER MEDAL, Inventions Exhibition, 1885.

London: Printed by WALTER KING (at the office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Jan. 5, 1892.